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DRUMMOND (O. A.). **Notas sobre o combate á septoriose do Tomateiro.** [Notes on the control of septoriosis of the Tomato.]—*Rodriguésia*, ii, Num. esp. (*1936*), pp. 333–336, [1937].

After stating that leaf spot (*Septoria lycopersici*) of tomato [*R.A.M.*, xvi, pp. 113, 279] is common in the Vicosa province of Brazil, where this crop is grown throughout the year, the author gives a tabulated account of a small range of experiments, the results of which showed that in three adjacent lots of 25 plants each the number of fruits produced was increased from 175 in the control plot to 609 in that sprayed with nosprasit and to 441 in that sprayed with 1 per cent. Bordeaux mixture. In a further test in two comparable plots, the total weight of the fruit produced in the plot sprayed five times with Bordeaux mixture was 324·6 kg. and the harvesting period lasted 23 weeks, as compared with 155 kg. and 16 weeks in the plot that received only one application.

GOIDÀNICH (G.). **Das Ulmensterben in Italien.** [The dying-off of Elms in Italy.]—*Z. PflKrankh.*, xlvii, 8, pp. 417–425, 8 figs., 1 map, 1937.

This is an abridged version of the writer's book on the Dutch elm disease (*Graphium* [*Ceratostomella*] *ulmi*) in Italy [*R.A.M.*, xvi, p. 141], presenting the salient facts concerning the varied (largely economic) uses of the tree, varietal reaction to the fungus, symptoms of the disease and its spread by *Scolytus* spp. and other insects, and control (chiefly by selection).

DOWSON (W. J.). **Bacterium salicis Day, the cause of the watermark disease of the cricket-bat Willow.**—*Ann. appl. Biol.*, xxiv, 3, pp. 528–544, 1 pl., 1937.

Details are given of inoculation experiments from 1934 to 1936, inclusive, at Cambridge with pure cultures of the organism (*Bacterium salicis*) [*R.A.M.*, xii, p. 60; xiv, p. 400] isolated from the sap of willow shoots exhibiting symptoms of the watermark disease as described by Day [ibid., iv, p. 321]. An approximately two-year-old tree inoculated in the stem in November, 1934, failed the following spring to produce new growth from four shoots above the inoculation points, while all the other buds on it opened and developed normally until at the end of

May a number of leaves all over the tree suddenly wilted, became discoloured, and the affected shoots died back. New shoots were affected in a similar manner until the end of July, after which no further dieback was observed; by the end of that summer, although the greater part of the main stem with its branches was dead or dying, there was plenty of apparently healthy growth arising from the base. In 1936 the buds were apparently healthy, but produced shoots which wilted suddenly and died back. In both years the watermark was present in the previous year's wood of shoots bearing healthy leaves, but not in their tips. The organism was re-isolated from this tree in 1935 and used as inoculum for further experiments in that season, in one of which a willow tree was inoculated in the three shoots composing it, and two of these shoots became infected, one dying early in the summer of 1936 after showing typical leaf symptoms. Of two trees inoculated in July, 1935, one showed by the end of September, 1935, a marked discoloration in the wood of the inoculated shoots. Three 6-month-old trees in pots, inoculated in July, 1935, exhibited a striking reaction to inoculation during the same year, but in 1936 developed normal foliage and showed no further sign of disease.

These results are considered to confirm Day's work, with the exception that, while in the pollard tree inoculated by Day one branch became typically watermarked the same season, in the author's experiments the typical symptoms did not appear until the following season, eight months later; trees inoculated as early as March, 1936, did not show any sign of the disease up to the time they lost their leaves in November. It is further pointed out that the inoculations were only successful on two- and three-year-old trees, and failed on those six months old. Diseased trees under three years of age have been found only very rarely in nature.

The possibility of trees recovering from the disease is indicated by the fact that two trees at the East Anglian Institute of Agriculture, Chelmsford, which in 1934 showed typical leaf symptoms on some of their branches, produced wholly normal growth in 1935 and 1936, and branches expected to show watermark only contained a dark brown stain in the 1934 wood. Furthermore, two diseased shoots, one from Cambridge and the other from Essex, planted in 1935, failed to give signs of disease either that year or in 1936, with no stain in any of the new shoots. This experiment confirms the observation that the causal organism spreads very slowly radially, and suggests the unlikelihood of the dissemination of the disease by planting obviously diseased setts.

Cultural studies of *Bact. salicis* isolated from *Salix coerulea* showed that it differs very slightly in its action on lactose, dextrin, and inulin from the strain obtained from *S. alba*. It is very similar to *Bacillus tracheiphilus* [*Erwinia tracheiphila*] and to a lesser degree to *B. amylovorus* [*E. amylovora*], its group number being 222.2222022 and its index number 5010–32000–1222. In the appended revised description of *Bact. salicis* it is stated that it is a straight cylindrical rod with rounded ends, arranged singly or in pairs end-to-end, rarely in chains, 0·8 to 1·7 by 0·5 to 0·7 μ for single cells, and 1 to 2·2 by 0·5 to 0·7 μ for pairs, and actively motile by 5 to 7 long peritrichiate flagella. It is Gram-negative, not acid-fast, aerobic, and facultatively anaerobic, does not form spores, produces

acid but not gas in xylose, mannose, galactose, dextrose, sucrose, maltose, raffinose, glycerol, mannitol, and salicin, reduces nitrates, and only has a feeble, if any, diastatic action. On potato a characteristic bright yellow pigment is produced which tends to fade to pale brown in old cultures. As determined by a new method [which is briefly described], based upon acid production from sucrose, its optimum temperature for growth is 29° to 30° C., with a minimum between 5° and 10° and a maximum between 33° and 37°. The thermal death point is 50° to 51° for the *S. coerulea* strain and 51° to 52° for the *S. alba* strain. It withstands drying at room temperature for at least 11 days.

Sleeth (B.) & Bidwell (C. B.). **Polyporus hispidus and a canker of Oaks.**—*J. For.*, xxxv, 8, pp. 778–785, 2 figs., 1937.

Polyporus hispidus [*R.A.M.*, xvi, p. 292] has been found producing elongated, swollen cankers with a bark-covered sunken area bordered by one or more folds of callus overgrowth, on oaks in the Nehantic State Forest of Connecticut. The appearance of sporophores of the fungus and other features prevented any risk of confusion with the somewhat similar cankers due to *Strumella* [*corynoidea*: ibid., xiii, p. 605]. The fungus entered the heartwood through a dead branch or stub and produced an elongated, semi-oval region of white, crumbly decay, turning waxen-yellow with age. From ring counts of the earliest callus formation, the oldest cankers were shown to have been in process of development for over 30 years in the 60- to 70-year-old trees examined on a half-acre plot. In a 10-per-cent. survey of the 36 acres adjacent to this plot, the relative frequency of cankered oaks varied from 2 per cent. for white (*Quercus alba*) to 8 for chestnut oak (*Q. montana*) and 13 for black oak [*Q. nigra*]. Red (*Q. borealis*) and scarlet (*Q. coccinea*) oaks are also attacked. Of the average of 195 oaks per acre (the oaks constituting 90 per cent. of the stand) 13 (7 per cent.) were cankered. Cankers were observed from ground-level to a height of 35 ft., entailing a loss of the largest and best logs; they ranged from 1 to 14 ft. in length (average 3·2 ft.), and the average extent of advanced and incipient rot beyond the cankers themselves was 1·2 ft. The total loss per acre for the 36 acres surveyed was 2 per cent. of the cordwood and 3 per cent. of board feet volume, while in a selected $\frac{1}{10}$-acre plot these losses amounted to 29 and 33 per cent., respectively. Felling and utilization, where possible, is the best method of control.

Marchionatto (J. B.). **Argentine Republic. The effects of rust on the Poplar groves of the Delta.**—*Int. Bull. Pl. Prot.*, xi, 8, pp. 173–174, 1937.

A survey in 1937 revealed the widespread occurrence, first reported in 1936, of poplar rust (*Melampsora larici-populina*) [*R.A.M.*, xv, p. 618] in the islands of the Delta [Rio de la Plata] in Argentina. The identity of the causal fungus was confirmed by Unamuno in Madrid and Gäumann in Zürich, to whom specimens were sent for examination. Rust outbreaks are frequently aggravated by the simultaneous attacks on the poplars by *Septoria populi* [ibid., xiv, p. 15] and *Sphaceloma populi*.

WILSON (JANET M.). **The structure of galls formed by Cyttaria septentrionalis on Fagus moorei.**—*Proc. Linn. Soc., N.S.W.*, lxii, 1–2, 8 pp., 2 pl., 12 figs., 1937.

Cyttaria septentrionalis causes the formation of galls very varied in shape and size on the stems of *Fagus moorei* in New South Wales, though it does not cause serious damage to the tree. The infection is confined to the primary cortex, secondary phloem, cambium, and secondary xylem, and enlargement is due to an increase in the number of cells most pronounced in the xylem and phloem. The mycelium is distributed evenly throughout the tissue it invades and produces irregularly-shaped haustoria. Infection probably takes place from germinating spores on the young stem before secondary thickening is completed, the mycelium remaining dormant until the beginning of the second year's growth.

BJÖRLING (K.). **Blueing fungi found in deposits of green algae on trees.**—*Svenska SkogsvFören. Tidskr.*, xxxv, 3, pp. 250–258, 2 figs., 1937. [Swedish summary.]

In 1934 the writer observed in 11 localities of Sweden the blueing fungi *Cadophora fastigiata*, *Pullularia pullulans* [see next abstract], *Cladosporium herbarum*, another type of the last named approximating to *Hormodendrum cladosporioides* [*R.A.M.*, xiii, p. 22], and *Alternaria humicola* [ibid., xvi, p. 575] growing in symbiosis with green algae on various trees, mainly pine, birch, and beech. Positive results were obtained in inoculation experiments on pine with these five organisms. *Pestalozzia hartigii* [ibid., xv, p. 618] was also isolated from the trees in eight localities, but not in association with algae. In inoculation tests on pine it produced only a superficial black spotting.

The mycelial elements of the fungi usually entwined one, two, or four algal cells in such a way as to produce very intimate contact between the membranes of the two organisms. In some cases, moreover, the hyphal tips were extended and connected by cup-shaped haustoria to portions of the algal cells (exterior only). Although the exact degree of nutritional interchange between the two partners in this symbiotic association could not be ascertained, the balance would appear to incline in favour of the fungi.

The extensive occurrence of blueing fungi on growing trees probably exposes timber to frequent risks of infection both in the plantation and in storage.

RENNERFELT (E.). **Fungal infection of groundwood pulp. Researches into its sources and its development in the pulp.**—*Pulp Pap. (Mag.) Can.*, xxxviii, 8, pp. 561–568, 1937.

This is an abridged version of the author's comprehensive studies on fungal blueing of groundwood pulp in Swedish paper mills, associated with *Cadophora fastigiata*, *Pullularia pullulans*, and a large number of other organisms [see preceding abstract], a summary of which has already appeared from another source [*R.A.M.*, xvi, p. 574].

GAISBERG (ELISABETH v.). **Über die Adelopus-Nadelschütte in Württembergischen Douglasienbeständen mit Hinweis auf die bisher hier**

bekanntgewordene Verbreitung von Rhabdocline. [On the *Adelopus* needle-fall in the Württemberg Douglas Fir stands with a reference to the distribution of *Rhabdocline* on the basis of present information.]—*Silva*, xxv, 5, pp. 37–42; 6, pp. 45–48, 1 fig., 1 map, 1937.

Continuing her studies on the needle-fall of Douglas firs (*Pseudotsuga taxifolia* and vars.) caused by *Adelopus* [*gäumanni*] in Württemberg [*R.A.M.*, xvi, p. 507], the writer gives a fully detailed account of the occurrence of the disease in the individual silvicultural districts of the province in relation to the local climatic and ecological conditions. The fungus is gradually spreading northwards and its penetration into other parts of Germany is presumably only a question of time.

The sudden epidemic of needle-fall in May, 1934, was no doubt precipitated by the abnormally heavy rainfall of the four preceding years, followed by exceptionally dry weather at the time of the outbreak. The disease affects trees in the age groups between 10 and 40 years (mostly 20 to 30), generally growing in soils with an abundance of decaying humus provided by a covering of strewn needles and a mixed herbaceous flora. Infection is by no means confined to 'suppressed' members of a stand, but may be found causing complete defoliation of the 'leaders', while sound individuals have been observed in immediate proximity to diseased trees. The fructifications of *A. gäumanni* were everywhere present in profusion, chiefly on the 1934 needles, on which they were visible to the naked eye as narrow, soot-coloured stripes, but also on those dating back to five or even seven years. The honey fungus (*Agaricus melleus*) [*Armillaria mellea*] was found in some of the stands attacked by *Adelopus gäumanni* and may have hastened the normally rather slow course of infection by the latter, but in other cases *A. gäumanni* occurred quite independently of the honey fungus and there is evidently no necessary connexion between the two. Perithecial development in *A. gäumanni* was found to coincide closely with the development of the young shoots, maturing asci being observed in material collected early in May, with ascospore formation in full swing by the beginning of June and proceeding at least until the end of that month; by the close of July reproductive activity was practically at an end.

Rhabdocline pseudotsugae [loc. cit.] also came into prominence in Württemberg in 1934, though it had probably been present in the province since 1931. The symptoms induced by this fungus may be hard to distinguish from those due to *A. gäumanni*, and a study of the fruit bodies may be necessary to establish a reliable diagnosis. Those of *A. gäumanni* are in evidence all the year round in the shape of minute, black points along the stomatal rows, whereas *R. pseudotsugae* only begins to fructify in April and its orange-coloured pustules are readily recognizable in May and June on the under sides mostly of the previous year's needles, though two-year-old material bearing these organs in profusion has also been collected. As elsewhere in Germany, the slow-growing mountain types of Douglas fir from 10 to 30 years old are the chief hosts of *R. pseudotsugae*. In contrast to *A. gäumanni*, the foci of infection by *R. pseudotsugae* are mostly situated in the north of Württemberg, the fungus having probably been introduced into the locality either from the Treves centre or from the Palatinate.

No control measures have yet been devised against either of the fungi under discussion, and the economic advisability of spraying is very dubious.

ROHMEDER (E.). **Die Stammfäule (Wurzelfäule und Wundfäule) der Fichtenbestockung.** [Stem rot (root rot and wound rot) of standing Spruces.]—*Mitt. LandesForstverw. Bayerns*, 23, vii+166 pp., 23 figs., 1937. [Abs. in *Neuheiten PflSch.*, xxx, 5, p. 211, 1937.]

Red rot of spruces in Bavaria falls into two phases, viz., root rot due primarily to *Trametes radiciperda* [*Fomes annosus*: *R.A.M.*, xv, p. 184] and wound rot associated with a number of wound pathogens, including *Polyporus vaporarius* [*Poria vaporaria*: ibid., xiv, p. 803], *Polyporus borealis* [ibid., xv, p. 411], *P.* [*F.*] *hartigii* [loc. cit.], *P.* [*F.*] *pinicola* [ibid., xiv, pp. 193, 795], and *Stereum sanguinolentum* [ibid., xiv, p. 728 *et passim*]. Three external signs of root rot are an increase in girth of the lower part of the trunk, the formation of thicker lenticels, and resin exudation. Furthermore diseased wood gives off a duller sound than healthy in response to blows with the axe. Röntgen rays are employed by cabinet-makers to detect the presence of fungal infection in wood samples. Direct control measures are hardly practicable on a large scale and the application of preventive methods is advocated, including restriction of the spruce stand, selection of suitable sites in relation to the place of origin, planting in soil with a loose texture to facilitate deep rooting, and avoidance of wounds inflicted by human or animal agency, fire, and so forth.

SJÖSTRÖM (H.). **Iakttagelser och undersökningar över snöskyttets (Phacidium infestans) uppträdande pa Tallen i höjdlägen i Norrland och Dalarna.** [Observations and investigations on the development of the snow leaf fall fungus (*Phacidium infestans*) on Pines at high altitudes in Norrland and Dalarna.]—*Svenska SkogsvFören. Tidskr.*, xxxv, 3, pp. 205–249, 10 figs., 1 diag., 4 graphs, 1 map, 1937. [German summary.]

The development of *Phacidium infestans* [*R.A.M.*, xvi, p. 647] on the natural regeneration of pine stands in northern Swedish districts liable to heavy snowfalls is comprehensively discussed in relation to appropriate silvicultural measures for the reduction of injury from this source—complete elimination of the damage probably being impracticable in the circumstances. The origin of the planting material is of great importance, trees from regions with milder climates being unable to withstand the rigours of the northern winter. The time of felling may also play a part in the perpetuation of the fungus in localities experiencing long, snowy winters, immense numbers of spores having been found to accumulate in the crowns of trees cut down from September to December. The mycelium of *P. infestans*, however, is the chief means of dissemination under the snow cover, passing from diseased to healthy plants in characteristic patches. This mode of progression is naturally favoured by dense planting in concentrated groups, a practice that should be abandoned in favour of a more open type. Seedlings growing under trees with wide spreading crowns,

which catch and divert a large portion of the falling snow, are largely free from attack.

Di Micheli (G.). **Una nuova ruggine del Pino austriaco.** [A new rust of the Austrian Pine.]—*Alpe*, xxiv, 7, pp. 277–279, 2 figs., 1937.

The writer recently examined an Austrian pine (*Pinus nigra* var. *austriaca*) shoot from Trieste which was attacked by a blister rust corresponding morphologically with *Cronartium asclepiadeum* [*R.A.M.*, xiv, p. 339]. The aecidial stage of the rust, *Peridermium cornui*, is practically indistinguishable from that of *P. pini* [ibid., xvi, p. 358], and inoculation experiments on alternate hosts of *C. asclepiadeum* are in progress definitely to determine the identity of the Austrian pine parasite. The growth in diameter of the affected organs (mostly lateral branches) ceases and an asymmetrical appearance is produced, followed by the development of cankers over the diseased areas, desiccation, and gradual necrosis. Fresh crops of aecidia are produced annually in May and June. In cases of stem infection the entire tree should be destroyed, otherwise it is sufficient to cut away the diseased branches; care should be taken to keep the plantings free from alternate hosts of the rust.

Bailey (I. W.) & Vestal (Mary R.). **The significance of certain wood-destroying fungi in the study of the enzymatic hydrolysis of cellulose.**—*J. Arnold Arbor.*, xviii, 3, pp. 196–205, 1 pl. (facing p. 206), 3 figs., 1937.

In cut, exposed tissues of 114 species in 88 genera and 36 families of the gymnosperms and angiosperms the authors found wood-destroying fungi whose colourless hyphae perforated and progressed within the secondary walls of the tracheal cells and fibres. During their stages of elongation, the hyphae were extremely tenuous filaments which dissolved correspondingly minute elongated cavities, either cylindrical with conical ends or biconical, and of remarkably constant angularity. Enzymatic activity progressed parallel to the long axis of the fibrils and chain molecules of cellulose (which are generally recognized to be orientated approximately parallel to the long axis), or at an angle of from 20° to 25° to this axis.

Most of the specimens examined showed delicate, colourless hyphae and coarse, dark brown hyphae connecting with them. Both types were septate and showed no obvious clamp-connexions. The coloured hyphae were sometimes largely confined to the lumina of the rays and wood parenchyma, while at other times they occurred chiefly in the lumina of the vessels, fibre-tracheids, or libriform fibres. As the cavities formed by the colourless hyphae enlarged, the hyphae became dilated and encrusted with granular material. The vessels were occasionally attacked by the colourless hyphae, but the ray and wood parenchyma seldom, if ever. The fungi frequently dissolved the central layer of the secondary wall, leaving the inner and outer layers intact, suggesting that enzymatic activity may be retarded or inhibited in walls and layers that are very intensely lignified. They are regarded as ubiquitous forms attacking the vascular and fibrous tissues of the higher plants

when cut and exposed to the air, and are considered highly significant from a physico-chemical point of view.

In a note added to the paper it is stated that a specimen of *Acer rubrum* attacked by *Brachysporium* showed helically orientated cavities dissolved by the hyphae, and that Dr. D. H. Linder considers the fungi discussed to be Pyrenomycetes or imperfect stages of this group.

Bose (S. R.) & Sarkar (S. N.). **Enzymes of some wood-rotting Polypores.**—*Proc. roy. Soc.*, Ser. B., cxxiii, 831, pp. 193–213, 1937.

In the tests described in this paper the authors studied the enzymic activity of *Polyporus ostreiformis*, *P. zonalis*, *Polystictus hirsutus*, *P. sanguineus*, *P. leoninus*, *Trametes cingulata*, *T. lactinea*, and *Daedalea flavida*, all of which, to ensure comparable results, were grown in 2 per cent. malt extract solution with a P_H value of 6·8. Using the latest methods of determination, they found that the amount of enzymes in the substratum (extracellular enzymes) was much larger than that of the corresponding intracellular enzymes at all the stages of growth studied in pure culture, namely, in young mycelium, in old mycelium just before the production of fruiting bodies, and in the fruiting stage. This is interpreted as indicating that the major portion of the enzymes produced by the organisms is secreted into the substratum to convert the food materials into an available form. With the exception of catalase, it was shown that the activity of the enzymes was greater in the first than in the other two stages. The carbohydrases, the presence of which was established, included invertase, raffinase, maltase, amylase, emulsin, hemicellulase, cellulase, pectinase, and ligninase, but not lactase or zymase. Catalase was found in all cases as intracellular enzyme, and laccase was present in *P. sanguineus*, *D. flavida*, and *T. lactinea*. Lipolytic and proteolytic enzymes were also found in small quantities.

In tests on mango wood blocks, *P. ostreiformis* [*R.A.M.*, xii, p. 551] was found to be the most active wood-rotting species of the eight that were studied; like *P. zonalis*, *Polystictus leoninus*, and *T. cingulata*, it was not a rapid lignin-destroyer and possibly belongs to the cellulose-destroying group, whereas *P. sanguineus*, *D. flavida*, and *P. hirsutus* are to a great extent lignin-destroying.

Walker (J. C.). **Injury to Cabbage by lightning.**—*Phytopathology*, xxvii, 8, pp. 858–861, 2 figs., 1937.

Cabbage plants in Wisconsin fields are reported to be liable to injury or destruction in roughly circular spots by discharges of summer lightning, the milder form of damage being observed at the periphery of the affected areas and consisting in the death and collapse of the pith cells and the formation of a hollow region surrounded by a dark brown to black layer of desiccated tissue. Adventitious roots are commonly formed within this cavity, and bud stimulation at the leaf scar below the site of cortical injury (which is usually not appreciable) is a common response of the surviving plants. Plants damaged only in the pith may recover from the temporary shock and head normally, but extensive injury is apt to reduce growth and so diminish yield.

Brenchley (Winifred E.) & Watson (D. J.). **The influence of boron on the second year's growth of Sugar Beet affected with heart rot.** —*Ann. appl. Biol.*, xxiv, 3, pp. 494–503, 2 pl., 1937.

The results of the experiment discussed in this paper showed that when first year sugar beets were transplanted in the autumn from experimental plots at Rothamsted into pots each containing about 25 lb. of sand carefully washed free from boron, all the plants during the second year's growth exhibited characteristic signs of boron deficiency (blackening and death of stem apices and flower buds), independently of whether the plants before transplanting were or were not affected with heart rot [*R.A.M.*, xvi, p. 790] of different degrees of severity. In a parallel series all the plants that survived transplanting to sand and received 0·25 or 0·5 gm. boric acid per pot produced healthy shoots with no deficiency symptoms; the plants that were originally affected with heart rot, and whose main axis was killed, put forth a number of healthy lateral shoots and flowered abundantly. The percentage of plants that failed to survive transplanting was much greater by 50 per cent. in the pots receiving 0·5 gm. boric acid than in those with the smaller dose, suggesting that the heavy dose possibly exerted a toxic action on the plants that were not constitutionally able to start new growth immediately after transplanting. The addition of boron did not improve the condition of roots originally affected with heart rot, as these were irremediably damaged. These results indicate the possibility of obtaining more or less normal yields of sugar beet seed from crops reserved for seed but affected with heart rot, by planting them in soil containing an adequate supply of boron or, if the soil is deficient in this element, by applying to it small amounts of boron compounds.

Action of boron on cereals. Action of boron on roots and tubers.—*Rech. Fertil. Sta. agron., Minist. Agric., Paris*, x, pp. 137–143, 1937. [French. Abs. in *Chem. Abstr.*, xxxi, 19, p. 7171, 1937.]

In a series of studies on the influence of boron on various agricultural plants in France, H. Burgevin found that the application of 10 kg. boric acid per hect. to sugar beet fields is adequate for the control of heart rot [see preceding abstract] and exercises no immediately harmful action on the following cereal crops. Caution is indicated in the use of boric compounds, since the cumulative effects of boron may be injurious; the margin between an effective and a toxic dose is comparatively narrow. C. Brioux and E. Jouis found in pot tests that 10 kg. sodium borate per hect. suffices for the control of heart rot and that the amount applied should not exceed 20 kg. G. Joret and H. Malterre observed that boron may either exert no action or depress the sugar beet yield in the absence of heart rot in the loam soils of Santerre. J. Garola found that boron affords some protection against heart rot but does not influence the average root weight.

Gram (E.). **Afsvampingsundersøgelser. V. Runkel- og Sukkerroefrø.** [Investigations on seed disinfection. V. Mangold and Sugar Beet seed.]—*Tidsskr. Planteavl*, xlii, 2, pp. 250–284, 2 graphs, 1937. [English summary.]

Full details are given of the further trials in the control of root rot

of mangolds and sugar beets [*Phoma betae*, *Pythium de Baryanum*, and *Aphanomyces levis*] in Denmark by means of seed disinfection during the decade that has elapsed since the publication of a previous report on this subject [*R.A.M.*, vi, p. 72]. Most dealers now supply seed treated by the semi-dry method, so that the bulk of the 3,000 tons sown annually is insured against the pathogens in question at an estimated cost of Kr. 40 to 50 per ton. The losses due to root rot, which was previously shown to assume a virulent form about one year in every three, are apt to be under-estimated, and the results of these experiments leave no doubt as to the beneficial effects of seed treatment, not only on seed-borne organisms but also on those infesting the soil, in the great majority of cases. The most reliable data in yield determinations were secured by sowing the seed-clusters in ten replicate flats for each fungicidal dosage. The same lot of seed was used in successive tests, which were carried out in lime-deficient soil. During the winter the boxes were placed in a greenhouse, and in the spring dug in north of a hedge; summer experiments were a failure owing to favourable germination conditions. The dosage of a given fungicide recommended for practical use is fixed at a round figure near the optimum concentration. The admixture of water with disinfectant dusts (6 to 24 l. per 100 kg. seed) was originally introduced on hygienic grounds but has further been shown to increase the efficacy of the treatment.

In these experiments abavit B dust (750 to 1,000 gm. per 100 kg. seed) [ibid., viii, p. 515] failed to give adequate control. Betanal liquid [loc. cit.] was effective at a strength of 7·5 per mille (two hours' immersion). Betasan dust (with an admixture of water as indicated above) gave excellent results at a strength of 600 to 800 gm. per 100 kg. seed. Among other highly satisfactory treatments may be mentioned one hour's immersion in 4 to 6 per mille dahmit [ibid., xi, p. 117], 2 per mille germisan, 5 or 2 per mille sanagran [ibid., xv, p. 769], 2 to 3 per mille tillantin dansk [= ceresan-nassbeize], and dusting with an admixture of water with the same preparation (600 gm.) or tillantin 1875 [= ceresan U.T. 1875] at a concentration of 800 gm. per 100 kg. seed.

PIERCE (W. H.). **Legume viruses in Idaho.**—*Phytopathology*, xxvii, 8, pp. 836–843, 2 figs., 1937.

During 1935 and 1936 a number of leguminous plants affected by virus diseases were collected in Idaho and test inoculations made with material from these plants on disease-free seedlings of Stringless Refugee Green beans and Asgrow 40 and Perfection peas in order to identify the viruses concerned. Most of the hosts proved to be affected by more than one virus, though one was liable to predominate, e.g., pea virus 3 [*R.A.M.*, xvi, p. 791] on red clover (*Trifolium pratense*), bean (*Phaseolus vulgaris*) virus 2 [ibid., xv, p. 418] on white and yellow sweet clovers (*Melilotus alba* and *M. officinalis*) (indicating the importance of these alternate hosts in the overwintering of the viruses concerned), and pea virus 3 on peas. Of the local pea and bean viruses, the most important from an economic standpoint appear to be pea virus 3 [loc. cit.], bean virus 1 [loc. cit.], and curly top of sugar beets [ibid., xvii, p. 7], which may completely destroy susceptible bean varieties in years when the beet leafhopper [*Eutettix tenellus*] is prevalent. Red

clover was also attacked by bean virus 2, lucerne virus 2 [ibid., xiii, p. 489], and white clover (*T. repens*) virus 1 [ibid., xv, p. 418] (one plant only). Pea virus 3, lucerne virus 2, and white clover virus 1 also infected the sweet clovers, the first-named further being pathogenic to alsike clover (*T. hybridum*) and white lupins (*Lupinus albus*), while yellow trefoil (*Medicago lupulina*) was susceptible to white clover virus 1. Pea virus 1 [ibid., xvi, p. 651] occurred twice only, both times on peas.

Bremer (H.). **Krankheiten und Schädlinge der Küchenzwiebel.** [Onion diseases and pests.]—*Nachr. SchädlBekämpf., Leverkusen*, xii, 3, pp. 169–189, 15 figs., 1937. [English, French, and Spanish summaries on pp. 197, 201–202, 205–206.]

This paper contains a useful account, supplemented by bibliographical references, of some fungal, bacterial, physiological, and virus diseases of onions with a discussion of appropriate control measures. Most of the work has been noticed in this *Review* from time to time.

Ryžkov [Ryjkoff] (V. L.) & Vovk (A. M.). **A new disease of the Onion (Allium cepa).**—*C. R. Acad. Sci. U.R.S.S.*, xvi, 1, pp. 69–72, 2 figs., 1937.

An account is given of a disease of the onion which was first observed in 1936 attacking large numbers of the plants grown at the Agricultural Experimental Station of Alexeyevka, near Kharkoff. Besides a severe stunting of the bulbs (from an average of 5·08 cm. to one of 2·35 cm. in the Zittau onion), the disease is characterized by a mosaic-like mottling on the leaves, ranging from minute, more or less elongated specks to more or less wide light green or cream-coloured bands, and various malformations of the floral organs, resulting in the production of a very considerably reduced yield in seed (from an average of 5·54 gm. to 0·96 gm. in the authors' tests) the viability of which is also very much diminished (from 76·3 to 46·8 per cent.). Seedlings grown from seeds collected from diseased plants were much weaker than seedlings from healthy onion seeds, and developed a less powerful root system. The diseased bulbs did not reach maturity, and instead of being normally spheroidal they retained an elongated shape; the greater part of those that were stored germinated during the autumn, and failed to survive until the next planting season. Histologically the disease resulted in the loss of differentiation of the mesophyll, the palisade cells being indistinguishable from the cells of the deeper layers, hypoplasia of the stomata, and not infrequent formation of four instead of two guard cells, due to additional divisions. In heavily affected cells intracellular inclusions were found, consisting of homogeneous bodies, of which one or two, seldom more, were observed lying close to the nucleus. The disease was easily transmitted by rubbing the leaves of healthy plants with emery paper wetted with the juice of diseased plants, the incubation period lasting from 10 to 14 days. The disease is stated to differ from yellow dwarf [*R.A.M.*, xvi, p. 724] in that it does not attack the flowers, and is attributed to an undescribed virus.

Fleischmann (R.). **Beobachtungen über das Welken der Linsen.** [Observations on Lentil wilt.]—*Pflanzenbau*, xiv, 2, pp. 49–56, 3 figs., 1937.

Lentils in Hungary, especially in acid soils, are liable to a wilt disease (tentatively attributed by B. Husz to a *Fusarium* [*R.A.M.*, xi, p. 282]), causing a yellow discoloration and shrivelling, often followed by collapse in windy weather. An examination of diseased specimens by [G.] Gentner, of the Bavarian Agricultural Institute, however, revealed no evidence of a fungal or bacterial pathogen, but it is thought that soil bacteria may be responsible. In a germination test of healthy and diseased seeds in 1935, 85 per cent. of the former emerged compared with only 49 per cent. of the latter, 10 per cent. of which subsequently contracted the wilt symptoms. The yield from a stand of lentils raised from healthy seed of the foregoing trial plots amounted to 9·6 dz. [960 kg.] per hect. compared with 6 dz. [600 kg.] from diseased material. It would thus appear practicable gradually to develop a wilt-resistant population by means of mass selection. In this connexion attention is drawn to the superiority of the small-sized lentils over the large types from the standpoint of disease resistance, and some observations are made on the desirability of extending the cultivation of the former.

Bewley (W. F.), Harnett (J.), & Williams (P. H.). **The control of white plaster mould (Oospora fimicola) on Mushroom beds.**—*Gdnrs' Chron.*, cii, 2642, p. 130, 1937.

The following treatment is recommended for the elimination of *Oospora fimicola* from mushroom [*Psalliota* spp.] beds [*R.A.M.*, xvii, p. 13]. On the first sign of disease, after removing the infected and surrounding casing soil until the underlying compost is uncovered slightly beyond the white infected area, the white infected compost should be removed and replaced by acid peat, moistening thoroughly with dilute acetic acid (1 part 33⅓ per cent. acid to 7 parts of water by volume) from a syringe, and finally re-covering with fresh casing soil. Where shelves are used and the holes are deep, double thicknesses of newspaper should be placed on the surface of the bed beneath to protect the mushrooms from any acid dripping through. In order to prevent outbreaks of *O. fimicola*, the floor of the house, with which the compost of ground beds comes into contact, should be covered with a thin layer (½ in. in depth) of acid peat saturated with the above-mentioned acetic acid solution, a 2 gal. can being sufficient to treat 40 sq. yds. through a fine rose. In a block of houses with beds covering 11,000 sq. ft. only 15 areas of infection appeared where this treatment was applied, and the fungus was promptly suppressed by the methods indicated above. Wooden shelves should not only be sterilized with formaldehyde (1 gal. in 49 of water) but also flamed with a large blow-lamp between each crop. The yield from the beds treated by the curative method herein described totalled 2½ lb. per sq. ft., whereas without disinfection it would not have exceeded ½ lb., judging by recent experiences.

Brown (H. P.). **Mushroom bed invaders. Their habits and the means of control.**—*Agric. Gaz. N.S.W.*, xlviii, 8, pp. 436–439, 6 figs., 1937.

Notes are given on the so-called 'weed fungi' [cf. *R.A.M.*, xvi, p. 15]

most commonly invading cultivated mushroom [*Psalliota* spp.] beds in New South Wales, including *Monilia* [*Oospora*] *fimicola* [see preceding abstract], *Papulaspora byssina* [ibid., xvi, p. 653], ink cap (*Coprinus* spp.), which is common, but not serious, *Pseudobalsamia microspora* [ibid., xvi, p. 86], noted at Sydney, in May, 1937, *Clitocybe dealbata* [ibid., xiv, p. 739], found at Sydney in 1936, and *Xylaria vaporaria* [ibid., xiv, p. 555]. Control is recommended by sanitation and disinfection. All possible sources of infection must be considered, including the composting ground, interior of the house, and the earth floors. All parts of the compost heap must be exposed to full heat, and the composting ground changed at intervals. If infection is suspected to have originated in the composting ground it should also be disinfected with commercial formalin (1 in 50). Casing soil, before being placed on the beds, should be disinfected by heat or with formalin (1 in 50, ½ gall. per cu. ft.). Earth floors should be treated with formalin between the crops. Houses should be fumigated by burning sulphur, using 5 lb. per 1,000 cu. ft. of air space, or sprayed with formalin. Infected beds should be moistened well with formalin before being removed as far as possible from the new beds.

HASHIOKA (Y.). **Relation of temperature and humidity to Sphaerotheca fuliginea (Schlecht.) Poll. with special reference to germination, viability, and infection.**—*Trans. nat. Hist. Soc. Formosa*, xxvii, pp. 129–145, 1 fig., 1937.

In controlled greenhouse experiments a temperature range of 22° to 31°, culminating at 28° C., was found to be very favourable to conidial germination in *Sphaerotheca* [*humuli* var.] *fuliginea*, the agent of a serious disease of Cucurbitaceae [*R.A.M.*, xvi, p. 653] and other plants in Formosa, the minimum and maximum for the process being about 15° and 34°, respectively. In a saturated atmosphere the proportion of germinating conidia varied between 15 and 80 per cent. with the source of the test material, probably averaging about 30 per cent., but in drops of water or dilute sugar solutions germination either did not occur or was very poor. Haustorial formation was most profuse at 28° in inoculation tests on one-week-old Fushinari cucumber seedlings, the optimum temperature for the infection of which was also about 28°, corresponding with the above-mentioned observations on conidial germination. The incubation periods of the fungus at 19·5° to 20·5°, 24° to 28°, and 32° (at which temperature the symptoms are barely perceptible) were found to be 4, 3, and 7 days, respectively. On seedlings under bell jars at a temperature range of 22·5° to 31·5°, germination occurred within 11 hours at saturation point but was more or less sparse in the other relative humidity series (46 to 51, 64 to 67, and 88 to 97 per cent.). In another experiment infection occurred more severely at 96 per cent. air moisture than at 97 or 100 per cent. and at 69 per cent. than at 55 per cent. In viability tests conidia were rapidly killed at the higher temperatures and lower humidities, but at 0° to 4·5° survived 14 days at 76 to 80 per cent. relative humidity, 24 days at 93 to 98 per cent., and 38 days in a saturated atmosphere; and at 10·5° to 15·5° 24 days in a saturated atmosphere. The formation of

conidia was much reduced in a saturated atmosphere but was abundant at 76 to 93 per cent. air humidity.

The bearing of these experimental data on the pathogenicity of *S. humuli* var. *fuliginea* under the prevailing weather conditions in Formosa is discussed. At Taihoku the mean temperature rises during July to a maximum of 28·2°, corresponding with the optimum for the growth of the fungus, and sinks to a minimum of 14·8° in February. Within these limits, therefore, *S. humuli* var. *fuliginea* would be well able to persist throughout the year, but actually it is exposed to greater extremes both of heat and cold during certain seasons. The atmospheric humidity of Formosa falls mostly within the range of 75 to 80 per cent. (minimum and maximum 72·8 and 85·5, respectively); excessively heavy precipitation tends to suppress the growth of the organism on the upper leaf surfaces. It is improbable, however, that such adverse factors are sufficient to prevent the overwintering of the cucurbit mildew in the conidial stage in Formosa, especially in view of its numerous alternate hosts.

François (E.). **Un grave péril. La "mosaïque" du Manioc.** [A serious danger. Cassava mosaic.]—*Agron. colon.*, xxvi, 236, pp. 33–38, 1937.

Up to 1936, cassava mosaic [*R.A.M.*, xvi, pp. 87, 301] was endemic in a mild form in Madagascar, where it was most prevalent on the local or Malgache variety even when grown under the most favourable conditions, though varieties obtained from seeds and those recently introduced on account of their high yield appeared to be immune in all districts. In 1936, however, the disease suddenly became so severe that in many localities the crop had to be abandoned, especially in the north, near Lake Aloatra. In addition to the usual symptoms the affected plants showed dwarfed, twisted stems with very short internodes bearing tiny leaves, and succumbed with the onset of the dry season. In the winter of 1936–7, the disease spread all over the island and even in the best crops, at Aloatra, the Malgache variety showed 100 per cent. infection. At Nanisana the losses amounted to 50 per cent. The most recent plantings were the worst affected. Even varieties previously regarded as immune became slightly affected. The disease is thought to be transmitted by an Aleurodid which was abundantly present on the plants. Further study of the problem is in progress.

Kvičala (B.). **Náchylnosť odrůd Soji ku bakterielni spále, zjištěná umělou infekcí. Předběžné sděleni.** [Susceptibility of Soy-bean varieties to bacterial blight, as determined by artificial inoculations. Preliminary communication.]—*Ann. Acad. tchécosl. Agric.*, xii, 3, pp. 266–271, 4 figs., 1937. [German summary.]

In this note the author states that soy-bean, a new introduction into Czechoslovakia, was severely attacked in several localities by bacterial blight, the causal organism of which was isolated and identified as *Bacterium glycineum* [*R.A.M.*, xv, p. 632]; the disease is thought to have been brought into the country with the seed. Preliminary experiments showed that of the eight soy-bean varieties which were tested,

Bratislavska yellow Sl. 1, Plattska large yellow, and Brnenska Chmelarova SVA 1 were the most resistant to infection.

Petri (L.). **Trasmissione del 'virus' dell'arricciamento della Vite attraverso i tessuti di una varietà resistente.** [The transmission of the Vine leaf roll virus through the tissues of a resistant variety.]—*R. C. Accad. Lincei*, Ser. 6, xxv, 9–10, pp. 413–416, 1 fig., 1937.

This is an expanded account of experiments already noticed from another source [*R.A.M.*, xvi, p. 587] on the transmission of vine leaf roll from infected Negro amaro vines through the intermediate graft of the resistant Malvasia bianca to a healthy scion of Negro amaro grafted on the Malvasia bianca. The Negro amaro grafts subsequently showed all the external symptoms of leaf roll, while Malvasia bianca remained externally unaffected. The presence of endocellular cordons in the American stocks and in Negro amaro, but not in Malvasia bianca, is stated to afford a further confirmation of the view that these structures are a specific internal symptom of leaf roll [cf. ibid., xvi, p. 704]; it also shows that the virus is transmitted unchanged from the infected vine to the susceptible graft, through the intermediate resistant graft, without the last-named showing any appreciable reaction to local pathogenic activity on the part of the virus. The evidence did not indicate that the resistant variety, though still bearing leaves, exercised any inactivating or attenuating effect on the virus.

Gobbato (C.). **Principaes pragas e molestias das Vides cultivadas no Rio Grande do Sul.** [Principal pests and diseases of the Vine cultivated in Rio Grande do Sul.]—*Rodriguésia*, ii, Num. esp. (*1936*), pp. 187–190, [1937].

This is a very briefly annotated list of the chief pests and fungal or bacterial diseases of the vine in the South Rio Grande State of Brazil, among which the following may be mentioned: *Dematophora* [*Rosellinia*] *necatrix* [*R.A.M.*, xv, p. 774], *Cercospora viticola* [*C. vitis*: ibid., xv, p. 200], *Coniothyrium diplodiella* [ibid., xvi, p. 775], *Guignardia bidwellii* [ibid., xvi, p. 813], *Septoria ampelina* [ibid., x, p. 296], *Pseudopeziza tracheiphila* [ibid., xiv, p. 285], *Bacterium uvae*, and 'courtnoué' [ibid., xvi, p. 654].

Kreneis. **Auftreten von Coniothyrium diplodiella (Weissfäule) in Jugoslawien.** [The occurrence of *Coniothyrium diplodiella* (white rot) in Yugoslavia.]—*Weinland*, ix, pp. 184–186, 1937. [Abs. in *Neuheiten PflSch.*, xxx, 5, p. 207, 1937.]

Coniothyrium diplodiella [see preceding abstract] appeared in a Yugoslavian vineyard following a light hailstorm in July, 1936, causing partial or complete desiccation of the grapes. The berries fit for utilization yielded a mouldy must, but the flavour of the wine was in no way impaired. Control may be effected by dusting immediately after a hailstorm with a mixture of 60 per cent. sulphur, 32 per cent. vica cement, and 8 per cent. sodium carbonate, or by spraying with 0·5 per cent. potassium bisulphite.

Neergaard (P.). **Aarsberetning fra J. E. Ohlsens Enkes plantepatologiske Laboratorium 1. April 1936–31 Marts 1937.** [Annual report of the phytopathological laboratory of J. E. Ohlsen's widow from 1st April, 1936 to 31st March, 1937.]—11 pp., 1 fig., 1937. [English and Esperanto summaries.]

During the period under review the following fungi were detected among the 2,081 samples of garden seeds tested at the above-mentioned Copenhagen seed-grower's phytopathological laboratory. Severe infection by *Helminthosporium papaveris*, not hitherto reported from Denmark, was observed on the seeds and seedlings of *Papaver somniferum*, *P. paeoniflorum*, *P. mursellii*, and *P. rhoeas* [*R.A.M.*, xv, p. 743]. An *Alternaria* with slender, clavate conidia with long, filiform beaks and a variable number of longitudinal and transverse septa, measuring (beak included) 75 to 210 by 15 to 27 μ (average 136 by 19 μ), was present on 14 varieties of *Zinnia elegans* [ibid., xvii, p. 13]. *Fusarium avenaceum* was found to be seed-borne on 11 samples of several carrot varieties, from which the fungus was isolated and inoculated into seedlings and roots with positive results, producing in the former a wet rot and in the latter a brown, dry type of decay.

Adam (D. B.). **Notes on plant diseases in South Australia during the two-year period, 30th June, 1936.**—*J. Agric. S. Aust.*, xl, 4, pp. 732–734, 1937.

During the two-year period under review [cf. *R.A.M.*, xiv, p. 559] early blight of tomatoes (*Macrosporium* [*Alternaria*] *solani*) [ibid., xvi, p. 419] was of some importance, especially early in the season in ill-constructed greenhouses. *Colletotrichum atramentarium* [ibid., xvii, p. 60] is probably a source of greater damage to tomatoes [ibid., xv, p. 690] than is generally suspected.

A severe outbreak of 'streak' (tomato spotted wilt virus) [ibid., xvi, p. 843] was observed in a bed of green garden peas immediately following a tomato crop, and the same disease severely attacked cinerarias [*Senecio cruentus*], zinnias, and Iceland poppies [*Papaver nudicaule*: ibid., xv, p. 444] in suburban gardens.

Tulips grown from newly imported bulbs were infected in two instances by *Botrytis tulipae* [ibid., xvi, p. 43].

Vines within the last few years have shown symptoms resembling those of court-noué.

Noble (R. J.), Hynes (H. J.), Magee (C. P.), McCleery (F. C.), Birmingham (W. A.), Edwards (E. T.), & Brown (H. P.). **The occurrence of plant diseases in New South Wales, with particular reference to the three-year period ending 30th June, 1936.**—*Sci. Bull. Dep. Agric. N.S.W.* 57, 42 pp., 11 figs., 1937.

Brief, popular notes are given, based for the most part on observations made by the plant-pathological section of the local department of agriculture, on a large number of plant diseases (cereals, grasses, sugar-cane, field and forage crops, vegetables, fruit, and ornamentals) observed in New South Wales during the three years ending 30th June, 1936, special reference being made to the relative importance of the different diseases.

'Purple patch' of wheat and oats (*Rhizoctonia* [*Corticium*] *solani*; [*R.A.M.*, xiii, p. 295; xiv, p. 622], which in 1927 appeared in the South-Western Slopes, was also recorded during 1936 in other districts. The disease has caused serious damage on some occasions, the losses due to it in 1933 ranging from 15 to 35 per cent. Treatment of affected patches with sulphate of ammonia either before planting or when the disease appears in winter gives satisfactory results, particularly with oats.

Shepherd (E. F. S.). **Botanical and Mycological Division.**—*Rep. Dep. Agric. Mauritius, 1936*, pp. 30–33, 1937.

During 1936, the trial plot of sugar-cane varieties for resistance to leaf scald (*Bacterium albilineans*) [*R.A.M.*, xvi, p. 590], planted out in Mauritius in 1935, was kept under observation but the final tests have not yet been completed. Another trial for resistance to smut (*Ustilago scitaminea*) [ibid., xvi, p. 516] gave promising results and is to be continued. Tobacco seed-bed treatment with Cheshunt compound reduced black shank (*Phytophthora parasitica nicotianae*) [ibid., xvi, pp. 516, 841]. Further observations indicated that the apparently new virus disease of tobacco recently reported as associated with enations [ibid., xvi, p. 516] is a form of mosaic. What appeared to be leaf curl symptoms [see below, p. 138] were observed on a single tobacco plant, but attempts at transmission by grafting were unsuccessful. Sweet pea (*Lathyrus odoratus*) flowerheads developed wilt (*Glomerella cingulata*) and *Gerbera* sp. showed a similar disease.

Roger (L.) & Mallamaire (A.). **Notes de phytopathologie africaine.** [Notes on African phytopathology.]—*Ann. agric. Afr. occ.*, i, 2, pp. 187–206, 10 pl., 1937.

In these notes on plant diseases in the French tropical African colonies it is stated that in the Ivory Coast Liberian coffee cherries, even when free from insect attack, are liable to infection by *Trachysphaera fructigena* [*R.A.M.*, xiv, p. 153]. The severe outbreak of 1933 was favoured by a very humid season, but only slight infection occurred in 1934, as a result of prompt control measures which included spraying with casein-Bordeaux. Casein is indispensable to prevent the washing off of the deposit by heavy rain.

Coffee leaves in the Cameroons and in most plantations in the Ivory Coast are infected by *Irenina coffeae* [ibid., xiv, p. 397]; all cultivated species are affected, especially those with wide, thick leaves, such as Liberia and Indénié; *Coffea canephora* is also attacked. Usually little damage is done, but in some cases the trees languish, most of the leaves turn yellow and fall, the fruits dry up and drop, most of the flowers abort, and the crop is lost. Control, when necessary, consists in removing the affected leaves, spraying with casein-Bordeaux mixture, and applying an organic mineral fertilizer rich in nitrogen and potassium.

Macrophoma ensetes Sacc. & Scalia occurred on a *Musa sinensis* [? *M. cavendishii*] fruit in French Guinea, the skin of which was covered with small, black pustules; the superficial, brown-black, ovoid or rounded pycnidia measured 200 to 300 μ in diameter, and the short, hyaline sterigmata bore unicellular, hyaline, elongated, cylindrical spores, which were often irregularly rounded at the extremities and

measured 15 to 23 by 4 to 6 μ. The species differs distinctly from *Macrophoma musae* [ibid., xv, p. 137] in that its spores are narrower, never surrounded with a gelatinous substance, and have no hyaline appendage. It is probably saprophytic and is commonly present both in French Guinea and the Ivory Coast on over-ripe bananas, of which it is one of the rotting agents.

Passiflora quadrangularis fruits in the Ivory Coast were infected by a fungus regarded as *Botryodiplodia theobromae* but having erumpent, hairy pycnidia arranged singly but in close proximity to one another, and spores measuring 25 to 30 by 13 to 16 μ; the striation of the last-named organs recorded by some workers is not a constant character.

Cassava mosaic [ibid., xvi, p. 456] in the Ivory Coast has spread to the northern districts as a result of the use of diseased cuttings.

Other records are: *Cerotelium desmium* [ibid., xv, pp. 259, 779] on *Gossypium punctatum*, *Lasiodiplodia* [*B.*] *theobromae*, *Coniothyriella theobromae* [ibid., xv, p. 830], (?) *Clonostachys theobromae*, and *Fusarium theobromae* App. & Strunk [*F. javanicum:* ibid., iv, p. 569] on cacao pods, *Ustilago zeae* and *Diplodia macrospora* on maize [ibid., xiv, p. 564], *Helminthosporium lycopersici* on tomatoes [ibid., xv, p. 830], *Alternaria brassicae* on *Brassica oleracea*, *Sphaerostilbe* (?) *repens* on debris of undetermined husks, and *Ragnhildiana manihotis* [ibid., xv, p. 344] on cassava, all in the Ivory Coast; *H. oryzae* [*Ophiobolus miyabeanus*] occurred on rice, and *Curvularia lunata* [ibid., xvi, p. 771] on *Cucurbita pepo* fruits in French Guinea.

Thornberry (H. H.) & Anderson (H. W.). **Some bacterial diseases of plants in Illinois.**—*Phytopathology*, xxvii, 9, pp. 946–949, 1937.

Technical descriptions are given of five bacteria producing brown, necrotic, circular or angular lesions on the leaves of their hosts, viz., *Phytomonas polygoni* n.sp. on *Polygonum convolvulus*, *Phytomonas plantaginis* n.sp. on *Plantago lanceolata*, *Phytomonas colurnae* n.sp. on Turkish hazel-nut (*Corylus colurna*), *P.* [*Bacterium*] *cichorii* Swingle on wild chicory [*R.A.M.*, v, p. 275], and *P. helianthi* var. *tuberosi* n.var. on *Helianthus tuberosus*.

P. colurnae measures 1·0 to 1·8 by 0·8 to 1·0 μ, occurs in chains, pairs, or singly with rounded ends and irregular forms, uni- to biflagellate, forms an opaque, viscid, colourless growth on dextrose agar, hydrolyses starch, has minimum, optimum, and maximum temperatures and hydrogen-ion concentrations of 5°, 21°, and 35° and P_H 6·1, 7·2, and 10·0, respectively, and succumbs to methyl and crystal violet, dahlia, basic fuchsin, malachite and brilliant greens, phloxine, erythrosine, and acridine yellow at a dilution of 1×10^{-3}.

Bact. cichorii is a short rod, 1·0 to 1·5 by 0·5 to 0·8 μ, in chains, pairs, or singly, with 1 or 2 polar flagella, capsulate, forming on dextrose agar a raised, opaque, dull, smooth, yellow, viscid growth, the colonies being convex with finely granular internal structure and entire margin; gelatine is not liquefied, milk is peptonized, nitrates are reduced and the minimum, optimum, and maximum temperatures and hydrogen-ion concentrations are 12°, 25°, and 35°, and P_H 6·1, 7·2, and 9·0, respectively; the thermal death point is 52°, and the organism is destroyed by the above-mentioned dyes at the same strength.

P. helianthi var. *tuberosi* measures 1·5 to 2·5 μ, occurs in chains and pairs with rounded ends but no irregular forms, is faculatively anaerobic, motile by 2 to 4 polar flagella, produces a butyrous white growth on dextrose agar, does not liquefy gelatine, peptonize milk, or hydrolyse starch, has minimum, optimum, and maximum growth temperatures and hydrogen-ion concentrations of 12°, 25°, and 35° and P_H 4·1, 6·5, and 9·0, respectively, is destroyed by methyl violet, malachite green, and mercurochrome at 1×10^{-5} and by basic fuchsin, methylene blue, and eosin at 1×10^{-3}.

All the organisms were pathogenic to their respective hosts in artificial inoculation tests.

KENT (G. C.). **Some physical, chemical, and biological properties of a specific bacteriophage of Pseudomonas tumefaciens.**—*Phytopathology*, xxvii, 9, pp. 871–902, 1937.

Bacteriophages producing lysis of a strain of *Pseudomonas* [*Bacterium*] *tumefaciens* [*R.A.M.*, xv, p. 5; xvii, p. 17] isolated from apple and reisolated after three passages through tomato, were obtained from crown gall on tomato, sugar beet, and marguerite [*Chrysanthemum frutescens*], and from the healthy portions of galled tomatoes, but not from sound plants.

The properties of a single uniform phage isolate were determined during 25 months of continuous culturing in Chester's bouillon [ibid., xiii, p. 152], consisting of 2·5 gm. each of Bacto peptone and C.P. sodium chloride and 1·5 gm. Difco beef extract per l. distilled water. The phage was observed to cause agglutination of the bacteria during the process of lysis. It had a maximum titre of 10^{-11}, was inactivated by ten minutes' exposure to 95° C., retained its lytic action after rapid drying at 50° to 60°, and withstood ageing *in vitro* provided desiccation was prevented. The lytic properties of the phage further resisted exposure to 70 per cent. ethyl alcohol, 1/40 phenol, and 1 per cent. hydrogen peroxide for 6, 1, and 72 hours, respectively, and to 1/3,000 nitric acid and N/64 sodium hydroxide for one hour. Extraction of the phage was not effected by ether, chloroform, acetone, or butyl alcohol. It was not precipitated by ammonium sulphate, but some tests with neutral lead acetate gave positive results. The phage exhibited specificity towards certain strains of *Bact. tumefaciens*, especially those strongly pathogenic to tomato. It appears to be of little therapeutic value [ibid., xvi, p. 370] against crown gall in tomatoes, adsorption on to the bacteria being slow, incomplete, and incapable of producing inactivation of the pathogen.

POUND (F. J.). **Ecuador: its agriculture in 1937.**—*Proc. agric. Soc. Trin. Tob.*, xxxvii, 9, pp. 335–339, 1937.

In this paper, given as a talk before the Agricultural Society of Trinidad and Tobago in September, 1937, the author states that during his recent visit to Ecuador he observed that there has been no serious attempt as yet to control cacao diseases in that country. About 1890, seeds of Trinidad and Venezuelan cacao were imported into the country, where this type of cacao subsequently became highly popular under the name of Venezuelan. It was from this stock that planters found trees apparently resistant to witches' broom [*Marasmius perniciosus*: *R.A.M.*,

xvi, p. 728]. Two of the leading growers planted large quantities of seed of these trees, and though 70 to 90 per cent. of the seedlings died of *M. perniciosus* before they were one year old, the survivors made cacao fields where the Nacional variety failed. The oldest of these trees are now 9 to 10 years of age and show an incidence of brooms ranging from none to hundreds. Some of the resistant trees are large and on one estate about 15 out of a block of 17,000 were observed to be bearing at least 200 fine pods per annum with not more than 10 to 20 brooms. These trees are clearly super-self-compatible and highly valuable. Pods from many of the most resistant trees have been obtained and the resistance of the seedlings is to be tested in Trinidad and Tobago nurseries.

Owing to the rarity of Panama disease [*Fusarium oxysporum cubense*: ibid., ix, p. 45; xvi, pp. 300, 368, 656] in Ecuador, there is a promising future for the local banana industry.

TEMPEL [W.]. **Beispielsversuche zur Förderung der Beizung in Kleinbetrieben.** [Experiments to demonstrate and promote seed treatment in small holdings.]—*Kranke Pflanze*, xiv, 9, pp. 144–146, 1937.

The majority of the replies to a questionnaire concerning the extent and methods of seed-grain disinfection in Hesse-Nassau in 1934–5 having been very unsatisfactory, the writer obtained from three manufacturers a total of 320 disinfection machines (mostly drums, with 15 short disinfection apparatus, valued at a total of RM. 3,000), which were distributed among the villages with the worst records for seed treatment. A striking improvement in the situation was immediately noticeable, the proportion of oats treated in 1936 being 43 per cent. as against 22 per cent. in 1935, and in the following autumn some 432,000 kg. of rye and 368,000 kg. of wheat were disinfected by up-to-date methods. During the succeeding winter the average incidence of *Fusarium* in rye [*Calonectria graminicola*] was 11 per cent., although winter injury due to adverse weather conditions and other causes was very severe in the untreated stands. The estimated increases of yield in the treated rye and wheat crops amounted to 810,000 and 500,000 to 600,000 kg., respectively.

SCHMITT (A.). **Kosten und Wirtschaftlichkeit der Saatgutbeizung.** [Costs and economy of seed-grain disinfection.]—*Dtsch. landw. Pr.*, lxiv, 36, p. 436, 1937.

Now that the cost of cereal seed-grain disinfection has been so substantially reduced (by about 100 per cent. since 1925), it is recommended that German farmers should no longer hesitate to treat their autumn stands against *Fusarium*, which caused immense damage in the winter of 1936–7, necessitating extensive ploughing-up. In this connexion it is further pointed out that the cost of disinfecting rye and wheat amounts to less than 0·5 per cent. of the value of the yield, the corresponding figure for barley and oats being 1 per cent. Thus, the treatment of wheat and rye pays if only 1 out of 200 plants contracts infection and that of barley and oats if 1 out of 100 becomes diseased. When all charges for labour, material, and apparatus are deducted there should be a net profit of RM. 360·50 per 100 zentner [5,000 kg.] of wheat and of RM. 437·50 for the same quantity of rye.

Whiteside (A. G. O.). **The quality of rust-resistant hard red spring Wheats under development in Canada.**—*Cereal Chem.*, xiv, 5, pp. 674–682, 1937.

The three hard red spring wheats, Thatcher, Renown, and Apex, resistant to black stem rust (*Puccinia graminis tritici*) recently made available to western Canadian farmers, are discussed from the standpoint of milling quality on the basis of quality tests. The data so far accumulated indicate that these varieties compare favourably with the standard Marquis, Ceres, and Reward under normal conditions for the production of good milling wheat of the Manitoba Northern type and are distinctly superior in rust epidemic seasons, such as occurred in Manitoba and south-eastern Saskatchewan in 1935, with an estimated loss of upwards of $85,000,000.

Johnson (T.) & Newton (Margaret). **The effect of high temperature on uredial development in cereal rusts.**—*Canad. J. Res.*, xv, 9, pp. 425–432, 2 figs., 1937.

A tabulated account is given of greenhouse experiments in the winter of 1936 and the spring of 1937, in which wheat varieties normally susceptible to stem [black] and leaf [brown] rusts (*Puccinia graminis tritici* and *P. triticina*) and oat varieties normally susceptible to black (*P. graminis avenae*) and crown (*P. coronata avenae*) [*P. lolii*] rusts, were inoculated with these rusts, kept overnight in damp chambers at the favourable temperature of about 65° to 70° F., and then transferred to compartments of the greenhouse kept at more or less constant temperatures, the daily means ranging from between 55° to 59° up to a maximum of 95° to 99°. The results showed that there is an optimum range of temperature for the development of the uredo stage of each of the rusts, above which the vigour of the pustule development decreases progressively as the temperature is higher. Physiologic races of the rusts that at ordinary temperatures produce a '4' type of infection, tend at higher temperatures to develop a '3' type or an 'x' type, while at still higher temperatures the infection types become '2' or '1' or even merely necrotic flecks. Thus a host variety, susceptible at moderate greenhouse temperatures, may exhibit various degrees of resistance at higher temperatures. There was further clear evidence of physiologic races of a rust differing in their sensitiveness to temperature. In black rust of wheat, the cultures obtained by selfing the rust on the barberry for two or more generations were definitely more sensitive to high temperatures than races collected in the field. Brown rust of wheat and crown rust of oats were less tolerant of high temperatures than the wheat black rust, and at 94° the first-named usually failed to produce pustules. Experiments on the reaction of black rust of oats to temperature were too few to permit any definite conclusions.

While no attempt was made to determine the highest temperatures tolerated by wheat and oats, Little Club wheat did not appear to suffer appreciable injury at the highest mean temperature tested (97°), provided the soil moisture conditions were satisfactory. The authors consider that the relatively smaller damage caused in the great plains region by brown rust of wheat and crown rust of oats than by black

rust may be attributable to some extent to the response of these rusts to high temperatures.

HASSEBRAUK (K.). **Pilzliche Parasiten der Getreideroste. II. Mitteilung.** [Fungal parasites of the cereal rusts. Note II.]—*Phytopath. Z.*, x, 4, p. 464, 1937.

An examination at the Bureau voor Schimmelcultures, Baarn, of the fungal parasites observed by the writer to attack cereal rusts [*Puccinia* spp.] under very humid atmospheric conditions [*R.A.M.*, xvi, p. 237] established the identity of the organisms concerned as *Verticillium album minimum* (A. & R. Sartory & Meyer) Westerdijk, *V. compactiusculum* [ibid., xiii, p. 737], *V. malthousei* [ibid., xv, p. 775], and *Cephalosporium lefroyi* Horne, *V. niveostratosum* and *C. acremonium*, contrary to previous assumption, not being involved. *V. album minimum* is closely related to *V. coccorum*, a parasite of chrysanthemum rust (*P. chrysanthemi*) in Germany [ibid., xvi, p. 677].

AMES (L. M.). **Barberries immune or highly resistant to black stem rust of cereals.**—*Bull. Arnold Arb.*, Ser. 4, v, 11–13, pp. 57–72, 3 pl., 1937.

Particulars are given of the characteristics of 27 species of *Berberis* and *Mahonia* which may safely be grown for ornamental purposes in the United States without risk of contracting black rust (*Puccinia graminis*) and thereby endangering the success of the quarantine regulations for the control of this disease in cereals.

BRYAN (W. E.). **Breeding for smut resistance in Arizona-grown Wheat.** —*Tech. Bull. Ariz. agric. Exp. Sta.* 66, pp. 95–124, 4 graphs, 1937.

This is a fully detailed, tabulated account of experiments in breeding wheats resistant to bunt (*Tilletia tritici* and *T. levis*) [*T. caries* and *T. foetens*: *R.A.M.*, xvi, pp. 166, 523, *et passim*] in Arizona. The resistant varieties Hussar, Ridit, and Hope, used as parents, possess varying degrees of resistance as judged by the number of resistant and susceptible progenies appearing in the inoculated F_3, resistance being in the order named. No definite number of genetic factors is clearly indicated for any of the resistant varieties. In the Hope × Sonora cross a partial dominance of the susceptibility of the latter over the resistance of the former is indicated.

Under the conditions of these experiments it would appear that a true distribution of the genotypes in a cross in respect of resistance and susceptibility can only be determined by repeated testing of the progenies taken from all classes of the F_3. Nevertheless, the investigations have definitely shown the necessary steps to be taken in breeding for bunt resistance in crosses between resistant and susceptible varieties, the most important being (1) selection of the resistant parent; (2) crossing the resistant parent with the best standard varieties adapted to local conditions; (3) growing a sufficiently large number of F_1 and F_2 hybrids to insure a reasonable F_3 population; (4) inoculation of the seed of each F_2 plant used for growing the F_3 progenies; and (5) the selection of individual plants from zero- and low-infection progenies of the F_3 and later generations until immunity or high resistance has been fixed, care

being taken that the seed used in planting each progeny is thoroughly inoculated with the forms of smut against which resistance is sought. In these experiments some 2,000 hybrid progenies of the F_3 and later generations have been grown, comprising a total of over 80,000 individual plants; of these five have shown sufficient promise to justify testing for possible commercial use, namely 194–12–6 (Ridit × Pusa 4), 389–24 (Ridit × Escondido), and three 1076 selections (Ridit × Hard Baart).

Fellows (H.). **The infestation of soil with Ophiobolus graminis and its subsequent increase and spread in the soil.**—Abs. in *Phytopathology*, xxvii, 9, p. 956, 1937.

Field and greenhouse investigations have shown that the establishment of *Ophiobolus graminis*, the agent of take-all of wheat [*R.A.M.*, xvi, pp. 736, 801], in a new area is a slow and uncertain process. Greenhouse soil must contain at least 25 per cent., by volume, of infested soil to produce an appreciable incidence of disease in the succeeding wheat crop; infestation in a 15 per cent. mixture did not increase with four years' cropping. Non-infested soil, contaminated with a water suspension from an infested site, will grow diseased wheat plants in the greenhouse in two years' cropping. Infection did not develop during three years' field cropping, but when the soil was transferred to the greenhouse and cropped two more years, infection appeared. Non-infested soil, inoculated by light, superficial applications of infested soil to simulate wind blowing, did not produce diseased plants during three years' cropping in the field, but when transferred to the greenhouse and cropped for another two years, the disease developed from this source. *O. graminis* did not spread from infested to non-infested soil, placed in contact without mixing, unless wheat roots grew through the adjacent layers, in which case infection was more abundant when the roots spread from the non-infested to the infested soil than vice versa. Infested soils in contact with non-infested often lose their pathogenicity both in the field and in the greenhouse, while the disease may disappear spontaneously from take-all spots in the field. Dead, infected host debris carried infection in the greenhouse but not in the field in the writer's experiments. Spores from perithecia of *O. graminis*, which serve to perpetuate the fungus, are seldom encountered in the Middle West. Cultures on a barley-oats medium afforded a satisfactory field and greenhouse inoculum. The efficacy of crop rotation as a control measure against take-all is due to the elimination of the living wheat roots which assist so materially in the spread of the disease.

Fellows (H.). **Effect of climatic conditions on the prevalence of Ophiobolus graminis in the soil.**—Abs. in *Phytopathology*, xxvii, 9, p. 956, 1937.

Ophiobolus graminis, the causal organism of take-all in wheat [see preceding abstract], is not killed in pure culture by Kansas winter temperatures, nor is it influenced either in culture or in nature by abrupt changes from growing to sub-freezing temperatures. The thermal death point of both micro- and macrohyphae is 50° C. Soil infestation is only slightly reduced by high summer temperatures and drought. The abundance of the parasite in infested soil is liable to alteration by various

combinations of moisture, temperature, and soil consistency. Generally speaking, warm, loose soils retain a minimum of *O. graminis* and cool, compact, moist ones a maximum.

RADEMACHER (B.) & GLAESER (H.). **Über die Behebung der Heidemoor- oder Urbarmachungskrankheit auf Kupfermangelböden durch Zufuhr von geringhaltigen Kupfererzen und deren Aufbereitungsrückständen.** [On the elimination of the heath moor or reclamation disease on copper-deficient soils by the addition of ores with a low copper content and their dressing residues.]—*Metall u. Erz*, xxxiv, 15, pp. 402–405, 1 map, 1937.

The results of experiments initiated by the first-named writer in 1930 on the extensive newly colonized Lütjeholm heath in Schleswig-Holstein showed that copper sulphate may be replaced by finely ground ores containing minute quantities of copper and flotation residues for the control of the reclamation disease of oats, vegetables, and fodder crops without any loss of efficacy [*R.A.M.*, xvi, p. 665]. These otherwise worthless materials can thus be advantageously utilized as substitutes for the valuable copper sulphate, a point of no little importance in connexion with the four-year plan for German economic self-sufficiency [ibid., xvi, p. 479]. At a conservative estimate, the total reclamation-diseased area in the north-west and east of Germany covers 50,000 hect., entailing an annual consumption of 1,275 metric tons of pure copper for the copper sulphate treatment at the standard rate of 100 kg. per hect. It is naturally necessary to use larger quantities of the ground ores and residues (1,000 to 2,000 kg. per hect.) than of copper sulphate, but the cost of application should work out at about the same. The materials in question present various other advantages, including the following. The minute particles of copper are uniformly distributed throughout the soil. The copper sulphides, which undergo a slow conversion to sulphates, are less rapidly leached out by rain and ground water than pure copper sulphate and their action is consequently much more protracted. Copper slate contains a great variety of trace elements which are of great value in soils inadequately provided with minerals.

PETCH (T.). **More about Claviceps.**—*Naturalist, Lond., 1937*, pp. 25–28, 1937.

Ergots (*Claviceps* spp.) from various grasses [*R.A.M.*, xvi, p. 447] in England were kept in an air-tight case during winter and planted out on wet sand in April, 1935, when those from *Lolium perenne*, *Glyceria fluitans*, *Festuca arundinacea*, and *Arrhenatherum elatius* showed, respectively, 79, 50, 59, and 67 per cent. germination, while nearly 1,100 ergots from *Phragmites communis* were germinated. With few exceptions none had been subjected to freezing, and the result of another experiment confirmed the view that it is not essential to germination, though exposure to the weather during winter did assist this process.

Observations showed that at the beginning of germination the cortex splits longitudinally for a short distance, a semi-circular flap sometimes being turned back. The clava then grows out directly from the internal tissue; no mycelium is produced on the outside of the ergot. The radiating mycelium usually figured for *C. purpurea* at the base of the clava

develops only after the clava has reached full size, and in many of the author's experiments was not found. If the fungus is grown on sand and watered without wetting the head, the head remains cream-coloured or ochraceous. In large specimens the head is evenly subglobose, but in small ones it may be tuberculate. On oatmeal agar growth of the fungus is slow; a sparse covering of short, more or less erect hyphae appear, bearing conidia terminally on short lateral branches. In the author's experiments no morphological character was observed that separated *C. microcephala* from *C. purpurea*.

Ergots are often attacked and almost entirely consumed by insects, especially that on *A. elatius*, most of the examples of which both in 1935 and 1936 were damaged, apparently by a small weevil.

Haenseler (C. M.). **Correlation between winter temperatures and incidence of Sweet Corn wilt in New Jersey.**—*Plant Dis. Reptr*, xxi, 16, pp. 298–301, 1937. [Mimeographed.]

In connexion with a survey of the statistical data relating to winter temperatures in New Jersey from 1910 to 1936, inclusive, the writer discusses the bearing of this factor on the incidence of bacterial wilt of maize (*Aplanobacter stewarti*) [*R.A.M.*, xvi, p. 597]. In 1936, following a very severe winter, with a temperature index of 79·2 for New Brunswick, and also following a season with a low incidence of wilt, the disease was again present only in traces. On the other hand, the pathogen was much in evidence in the State in June, 1937, following an exceptionally mild winter, though apparently below the peak years of 1932–3. There is considered to be no doubt as to the correlation between mild winters and a high incidence of wilt and conversely between low temperatures and slight infection. However, a certain time factor or lag period seems to be involved in the relationship which requires further study before quantitative forecasts of wilt incidence can be reliably made. A single cold winter, for instance, after a period of wilt, may not suffice to reduce the causal organism or its vectors to such an extent as to give the expected control, while one mild winter does not necessarily so increase the pathogen and its carriers as to cause an exceptionally severe outbreak of wilt in the following summer.

Diehl (W. W.). **Ascochyta sorghina Sacc. on Sorghum in Alabama.**—*Plant Dis. Reptr*, xxi, 16, p. 309, 1937. [Mimeographed.]

In August, 1937, the writer examined specimens of sorghum from Alabama with large necrotic areas (up to 12 by 2 cm.) on the leaves bearing numerous pycnidia tentatively ascribed to *Ascochyta sorghina* [*R.A.M.*, xiii, p. 746], not hitherto recorded from North America. The active pathogenicity of the fungus in the material under observation, in contrast to its relatively mild character in Europe, suggests great susceptibility on the part of the local host.

Chapman (H. D.), Vanselow (A. P.), & Liebig (G. F.). **The production of Citrus mottle-leaf in controlled nutrient cultures.**—*J. agric. Res.*, lv, 5, pp. 365–379, 6 figs., 1937.

In the experiment discussed in this paper (conducted from March to 15th September, 1936, in a greenhouse at Riverside, California) rooted

Valencia orange cuttings were grown in nutrient solutions of varying composition. Mottle leaf [*R.A.M.*, xvii, p. 28] was produced by omitting zinc from the solutions, and in plants already affected with this condition the frequent addition to the solution of small amounts of zinc brought about a recovery. Mottle leaf was particularly severe in the cuttings that were grown in full light in the greenhouse (intensity about 80 per cent. of that out-of-doors), while those kept at lower light intensity (about 40 per cent.) were but slightly affected, this agreeing with the observation that in the field the leaves on the south side of citrus trees are usually more mottled than those on the north side. High nitrate content of the solutions appeared in the early stages of the test to favour mottle leaf development, but this observation needs further confirmation. Increases in phosphate appeared to accentuate the mottling and also the development of root rot, but these two conditions did not appear to be necessarily interrelated, since either could develop independently of the other. The results are considered to support the view that zinc is an indispensable plant food element, rather than that this element functions as an antiseptic or corrective.

Laffond (P.). **Les maladies cryptogamiques et physiologiques des Aurantiacées en Algérie.** [The cryptogamic and physiological diseases of Aurantiaceae in Algeria.]—*Bull. Synd. algér. Agrumes*, 7, 69 pp., 1936. [Abs. in *Hort. Abstr.*, vii, 3, p. 250, 1937.]

Among the Algerian citrus diseases described in detail in this publication, with sections on their control largely by Spanish and American methods, may be mentioned gummosis, due to an unidentified species of *Phytophthora* [*R.A.M.*, xvi, pp. 312, 529, *et passim*], mainly affecting lemon, followed in descending order of susceptibility by *Citrus medica*, *C. sinensis*, *C. nobilis*, *C. triptera*, *Fortunella japonica*, and *C. bigaradia* [*C. aurantium*]; collar rot (*Botrytis cinerea*) [ibid., xii, p. 283]; *Polyporus* spp. causing rot and *Diplodia natalensis* [ibid., xvii, p. 27] gummosis of the trunk and main branches and withering of the shoots; psorosis or scaly bark [ibid., xvi, p. 603]; melanosis (*Phomopsis* [*Diaporthe*] *citri*) [ibid., xvi, p. 744 *et passim*]; anthracnose (*Colletotrichum gloeosporioides*) [ibid., xvii, p. 25], lime-induced chlorosis of the leaves [ibid., xvi, p. 741]; mottle leaf [see preceding abstract]; minor leaf diseases due to *Sphaerella* [*Mycosphaerella*] *gibelliana*, *Phyllosticta* spp., and *Septoria limonum* [ibid., x, p. 24]; oleocellosis [ibid., xvi, pp. 300, 601] of the fruit; and blue and green moulds [*Penicillium italicum* and *P. digitatum*: ibid., xvii, p. 26].

Nattrass (R. M.). **Citrus wastage, a reminder.**—*Cyprus agric. J.*, xxxii, 3, pp. 74–78, 1937.

Detailed directions are given showing how the principal source of wastage in Cyprus citrus fruit (*Penicillium digitatum* and *P. italicum*) [*R.A.M.*, xvii, p. 27 and preceding abstract], exported to European markets, can be eliminated by improved orchard and packing-shed practices, wilting in suitably constructed rooms, and proper loading of lorries.

Bartholomew (E. T.). **Endoxerosis, or internal decline, of Lemon fruits.**—*Bull. Calif. agric. Exp. Sta.* 605, 42 pp., 1 pl., 5 figs., 1937.

Further investigations [which are fully described] carried out in California into internal decline of lemons [*R.A.M.*, xvi, p. 313] showed that the first symptom is the formation of desiccation cavities adjacent to the vascular bundles in the peel at the stylar end. The cells collapse and may be destroyed, often changing to pentoses, pentosans, and finally, to gum. The first visible evidence of the disease is a colourless gummy exudate when the peel is cut in the stylar region. In green fruits the first evident internal symptoms consist of pinkish to rust-brown areas in the vascular bundles of the nipple, many of the vessels being clogged with gum. Pink to rust-brown patches may next appear in any part of the albedo, and the cells and juice sacs of the pulp at the stylar end collapse. In certain localities and times of the year the vessels right through the centre of the fruit become discoloured and are filled with gum, though the other parts of the fruit are not seriously affected.

When the fruit has reached the 'silver' stage the loss of water and the collapse of pulp cells and juice sacs at the stylar end continue, more rapidly near the centre than the peel, particularly in the pithy core of the fruit. As the fleshy pulp tissues dry they generally turn pinkish or rust-brown; at this stage parts of the albedo and about one-fifth of the adjoining pulp at the stylar end are affected.

In yellow (tree-ripe) fruit the yellow or orange-yellow colour assumed by the stylar end of affected fruits persists while others are still green. The pulp tissues continue to collapse as long as the fruit remains on the tree. As a rule, when one-third to one-half of the pulp tissues at the stylar end are affected the fruit drops.

The maximum amounts of endoxerosis found in lots of yellow, silver, and green fruits were, respectively, 100, 85, and 60 per cent. Between 1st May and 1st November approximately 10 to 15 per cent. of the fruit picked in southern California is affected. Very slowly and very rapidly growing fruits are most susceptible. The strength of the acid in affected fruits is nearly as high as that of healthy ones, but the quantity is reduced.

Partial defoliation decreased endoxerosis during the summer months immediately following. Trees covered with cheesecloths remained almost entirely unaffected. Spraying with oil to reduce transpiration was not a practicable control method. Tests demonstrated that large amounts of water were removed from the fruits by the transpiring leaves, marked water deficits existing in the fruits. In summer, in the absence of fog, dew, or clouds, lemons begin to contract owing to water withdrawal at about 6 a.m., the process continuing until 5 or 6 p.m.; in winter the corresponding hours are 9 a.m. and 4 to 5 p.m. Affected fruits begin to contract later in the morning and to expand later in the evening than healthy ones. Twigs that had borne affected fruits withdrew an average of little more than one-half as much water from the potometers as did those that had borne healthy fruits. Less gas could also be forced through the former than the latter type of twig. Badly affected fruits floated higher in the washer than healthy ones, usually stylar end up. Gumming spreads into the woody parts of the pedicel and adjacent twig and governs the rate at which water is drawn from

the potometers. Slightly less endoxerosis ensued when the trees were irrigated from overhead than was the case when furrows were used. When lemon trees were grown in tanks those given the minimum amount of water developed much more endoxerosis than those given a medium amount, and those given the maximum amount were slightly more affected than those given the medium amount. No consistent difference was noted between the amounts of endoxerosis shown by the standard varieties Eureka and Lisbon, or between strains of either. The date of a first serious outbreak depends largely on the rainfall of the previous winter and the time of the first hot spell, and the condition was more prevalent on the south than on the north side of the trees, especially when young. Experimental evidence indicated that the chief causal factors inducing the condition are daily protracted water deficits in the tissues affected, high temperatures during active growth, and the presence of substances readily convertible into gum.

Ocfemia (G. O.). **The probable nature of 'cadang-cadang' disease of Coco-nut.**—*Philipp. Agric.*, xxvi, 4, pp. 338–340, 1937.

Coco-nuts on San Miguel Island (Philippines) were observed in 1931 to be affected by a disease known locally as 'cadang-cadang' or growth failure and involving 25 per cent. of the trees in some parts of the affected estate. The leaves were yellow and chlorotic, developing numerous yellowish, translucent spots which turned orange-yellow. From a distance the crown of the affected trees appeared yellowish-green. The pinnae were narrow and tended to bend over or break in the middle. The leaves gradually became smaller than those of the same age on healthy trees, and the blades of the pinnae of the middle leaves dried out, the leaves dropping prematurely. Infected plants were stunted and produced small, short leaves closely bunched at the end of the trunk. The leaf-dwarfing was followed by a gradual tapering of the trunk which finally appeared as a bare, pointed pole. As soon as the pinnae turned yellow, no further fruits were formed, though spathes were sometimes abundantly produced. The racemes dried out but remained on the tree. No organism was found, but the characteristics of the disease are considered to indicate that a virus may be responsible.

Pfältzer (A.). **De bestrijding van topsterfte.** [The control of top die-back.]—*Bergcultures*, xi, 39, pp. 1395–1400, 1937.

Rudin's conservative methods of pruning coffee trees for the control of top die-back [*Rhizoctonia* sp.: *R.A.M.*, xvii, p. 33], while admittedly presenting certain advantages, are not regarded by the writer as altogether satisfactory, at any rate in the Malang district of Java, where the following procedure is recommended. Regular surveys should be made by specially trained coolies for the presence of the disease, in the course of which fairly deep pruning should be carried out in young plantations and in slightly infected old ones, whereas in extensively diseased old plantations the regular excision of necrotic material is the most rational method of treatment, complete control at this stage being in any case impracticable. The best time for a thorough clean-up of the plantations is shortly after harvest. The young growth in old plantations

is exposed to particularly severe risks of infection by top die-back and is unlikely to reach maturity; to avoid loss of crop denser planting or the development of a several-stemmed growth habit should therefore be considered.

YABLOKOVA (Mme V. A.). Анатомическое изучение трахеомикозного увядания Хлопчатника при различных сроках заражения. [Anatomical study of the tracheomycotic wilt of Cotton, in relation to the time of infection.]—*Pl. Prot., Leningr., 1937*, 13, pp. 28–41, 12 figs., 1937. [English summary.]

This is a full report of the author's studies of the mechanism of infection of cotton with *Verticillium dahliae*, an abstract from which has been noticed from another source [*R.A.M.*, xv, p. 800]. The results indicated that inside the host the parasite is restricted to the vascular system, from which it cannot spread radially; this fact explains why infection during the early stages of growth, when the cotton plants are rapidly forming new layers of xylem, is much less dangerous to the crop than at the flower-bud formation stage, when the vascular system is more or less definitely established. It is suggested that the widespread outbreaks of the disease which are frequently observed in the U.S.S.R. in the form of chlorotic spots on the leaves at the time of blossoming are due to mechanical injuries to the roots by cultivation of the soil in the rows at the bud formation phase. Anatomical examination showed the presence of *V. dahliae* in the hypocotylar node of the cotton plants ten days after inoculation of the roots with cultures of the organism. In the author's tests infections were only successful at temperatures between 16° and 19° C., and not at 32° to 36°. Careful removal from the fields of all infected plant material is practised as a control measure against tracheomycosis.

YABLOKOVA (Mme V. A.). О проникновении **Fusarium buharicum** в проростки Хлопчатника. [On the penetration of *Fusarium buharicum* into Cotton seedlings.]—*Pl. Prot., Leningr., 1937*, 13, pp. 86–87, 1937.

The results of the experiments described in this note showed that spores of *Fusarium buharicum* [*R.A.M.*, xvi, pp. 373, 827] sprayed on two-day-old seedlings of the local cotton variety 1450 (highly susceptible) and of the American Upland No. 1306 (highly resistant or immune), penetrated the unwounded cortex of both hosts at the collar. The parasite spread to the other tissues of the susceptible host, eventually reaching the pith [ibid., xv, p. 800], but in the resistant variety its progress was soon inhibited by the death of the invaded areas and the accumulation in the tissues of a substance which was apparently toxic to the fungus. Inoculations of seedlings of both varieties at a later stage of development gave negative results. Further work is in progress to establish the nature of the resistance in the Upland cotton to *F. buharicum*.

MOORE (ELIZABETH J.). **Carbon and oxygen requirements of the Cotton root-rot organism, Phymatotrichum omnivorum, in culture.**—*Phytopathology*, xxvii, 9, pp. 918–930, 1937.

Phymatotrichum omnivorum, the agent of cotton root rot in the United States [*R.A.M.*, xvii, p. 24], was experimentally shown to be

capable of utilizing for nutrient purposes a large variety of carbon compounds, including dextrose, levulose, galactose, maltose, sucrose, lactose, mannite, xylose, inulin, dextrin, soluble starch, potato starch, maize starch, glycerine, and cellulose. Acidification occurred rarely in cultures with glycerine or cellulose as the source of carbon and never in dilute root decoctions or in the controls without carbon, but it took place in all the other carbohydrate media. Growth may occur with or without acidification of the medium. Agar cultures are somewhat more favourable than liquid ones to the development of *P. omnivorum*, and show considerably more rapid acidification in spite of being more highly buffered. The activities of the fungus are checked by anaerobic conditions [ibid., xii, p. 216]; they are stimulated by the presence of 42 per cent. oxygen (in liquid cultures only) but depressed by 10½ per cent. (slightly in agar and markedly in liquid media). Expressing the growth of *P. omnivorum* and the acidification of the substratum as utilization quotients, the averages are much less for liquid than for agar cultures at the oxygen concentrations tested. In submerged cultures the quotients vary directly with the oxygen concentration. In agar cultures the highest utilization quotient occurs in normal atmospheric oxygen, which is near the optimum concentration for exposed mycelium. The metabolic processes of the fungus are thus closely associated with the oxygen supply to the mycelium.

Moore (J. H.) & Rankin (W. H.). **Influence of 'rust' on quality and yield of Cotton and the relation of potash applications to control.**—*Bull. N.C. agric. Exp. Sta.* 308, 18 pp., 7 figs., 1937.

Tests [which are described, and the results of which are tabulated] carried out in North Carolina from 1934–6, inclusive, showed that when potash in amounts ranging from 25 to 50 lb. per acre was applied to cotton fields subject to 'rust' [*R.A.M.*, xvi, p. 156] and was used to supplement a fertilizer consisting of 3 per cent. nitrogen, 8 per cent. phosphoric acid, and 3 per cent. potash, applied at planting at the rate of 400 lb. per acre, the resultant cotton plants gave significantly greater yields of cotton, heavier seed, heavier bolls, a higher lint index, a better grade, a longer staple length, a stronger fibre, and a lower percentage of thin-walled fibres than the control plants given the 3–8–3 fertilizer but not the extra potash after planting.

It is recommended that where, as in the locality concerned, groundnuts are grown in rotation with cotton, supplementary potash applications should be made to the usual fertilizer application (except perhaps when as much as 8 per cent. potash is used in the fertilizer) soon after chopping. Though applications of potash effectively reduce rust damage it is suspected that factors other than potash may be involved in the disorder and that further studies may reveal other methods of control.

Ivanić (M.). **Beiträge zur Kenntnis eines im Enddarme des grünen Wasserfrosches lebenden Pilzes Blastocystis ranarum spec. nov.** [Contributions to the knowledge of a fungus, *Blastocystis ranarum* spec. nov., inhabiting the rectum of the green aquatic Frog.]—*Cellule*, xlvi, 2, pp. 159–178, 1 pl., 31 figs., 1937.

This is a comprehensive discussion of the cytology, life-history, and

systematic affinities of *Blastocystis ranarum* n.sp. [no Latin diagnosis], a constant occupant of the rectum of the green aquatic frog (*Rana esculenta*) in Yugoslavia. Studies on the genus *Blastocystis* [*R.A.M.*, xvi, p. 462] having hitherto been largely confined to *B. hominis* [ibid., xvi, p. 100], the detection of an allied species in the lower animals (the writer has also observed one of uncertain identity, possibly *B. hominis*, in a cockroach, *Periplaneta orientalis*) is of interest. The genus is considered to be closely related to the Myxomycetes.

Anderson (C.), Brun (G.), & Coursières (H.). **Note sur le XXII-e cas de pied de Madura observé à Tunis.** [Note on the 22nd case of Madura foot observed at Tunis.]—*Arch. Inst. Pasteur Tunis*, xxvi, 1, pp. 156–159, 1 pl., 1937.

Details are given of a case of 'Madura foot' [*R.A.M.*, xv, p. 21] in a 45-year-old Tunisian native, with observations on the diagnostic complications incidental to this condition. In the present instance the disorder would appear to be of actinomycotic origin (as in 12 previous cases recorded in Tunis), though other fungi have also been reported as agents in the same region.

Dunlap (A. M.). **Otomycosis.**—*Chin. med. J.*, lii, 3, p. 446, 1937.

A brief note is given on human otomycosis associated with *Aspergillus niger*, *A. flavus*, and *A. fumigatus*, which is stated to be exceptionally prevalent in China [*R.A.M.*, xiv, p. 632] and elsewhere in the Orient.

Ikeda (K.). **Monilia infection of the lungs (bronchomoniliasis.)**—*Amer. J. clin. Path.*, vii, 5, pp. 376–388, 5 figs., 1937.

This is a full discussion of the pathological anatomy of bronchomoniliasis (*Monilia* [*Candida*] *albicans*) in man and in experimental animals, supplemented by an outline of the pathogenesis of the disease, which may, in the writer's opinion, be recognized as a definite clinico-pathological entity [*R.A.M.*, xvi, p. 177].

Brandt (R.) & Zach (F.). **Torula histolytica als Erreger einer Pilzerkrankung des behaarten Kopfes.** [*Torula histolytica* as the agent of a fungal disease of the scalp.]—*Derm. Wschr.*, cv, 37, pp. 1180–1181, 1937.

From scales of the seborrhoeic type on the scalp of an 18-year-old girl in Vienna the writers isolated the fungus known as *Torula histolytica* [*Debaryomyces neoformans* or *Cryptococcus hominis*: *R.A.M.*, xvi, p. 610, and next abstract], which is stated to have been described by S. Wolfram and F. Zach as *T. diffluens* n.sp. (*Arch. Derm. Syph., Berl.*, clxx, p. 681, 1934).

Crone (J. T.), De Groat (A. F.), & Wahlin (J. G.). **Torula infection.**—*Amer. J. Path.*, xiii, 5, pp. 863–880, 2 pl., 1937.

From the spinal fluid of a 25-year-old negro, who succumbed to an attack of generalized torulosis, the authors isolated a species of *Torula* which corresponded in morphological, cultural, and biochemical characters and thermal relations to that described as *Torula histolytica*

[*Debaryomyces neoformans* or *Cryptococcus hominis*: see preceding abstract]. Intraperitoneal inoculation of mice proved to be of great assistance in establishing the etiological diagnosis of the disease.

Dickson (E. C.). **'Valley fever' of the San Joaquin Valley and the fungus Coccidioides.**—*Calif. West. Med.*, xlvii, 3, pp. 150–155, 1937.

Full clinical details are given of five non-fatal cases of the disease known as 'valley fever', which occurs in the San Joaquin Valley of California and is believed to represent a primary acute manifestation (associated with a cold or bronchopneumonia and erythema nodosum) of coccidioidal granuloma (*Coccidioides*) [*immitis*: *R.A.M.*, xvii, p. 36]. The fungus was isolated from all the patients, four of whom contracted the disease spontaneously while the fifth was exposed to infection in the laboratory.

Cavallacci (G.). **Granuloma del limbus da Sporotrichum.** [Granuloma of the limbus due to *Sporotrichum.*]—Reprinted from *Arch. Ottalmol.*, xliv, 7–8, 20 pp., 4 figs., 1937.

Clinical details are given of a case of granuloma of the limbus of the eye in a young man, associated with *Sporotrichum beurmanni* [cf. *R.A.M.*, v, p. 554; xvii, p. 39] and following injury from a willow branch. Inoculation experiments on laboratory animals gave positive results. Particular interest attaches to the case under observation, not only by reason of the very unusual site involved, but also because of the rarity of ocular sporotrichosis in general in Italy.

Benatar (R.). **Contribuição ao estudo e tratamento das mais communs doenças de Roseiras.** [Contribution to the study and control of the more common diseases of Roses.]—*Rodriguésia*, ii, 8, pp. 9–23, 9 pl., 1937.

This is a very brief, popular account of the more common diseases of the rose occurring in the Districto Federal of Brazil, together with recommendations for their control. The diseases dealt with include mildew (*Sphaerotheca pannosa*), rust (*Phragmidium subcorticium*) [*P. mucronatum*], black spot (*Diplocarpon rosae*, in the imperfect stage only), grey spot (*Mycosphaerella rosigena*) [*R.A.M.*, xi, p. 517], and leaf spots due to species of *Cercospora*, including *C. rosicola* and *C. hyalina* [ibid., xv, p. 59], *Septoria rosarum*, and *Phyllosticta rosae*.

Schmidt (H.). **Auffällige Pilzkrankheiten im Jahre 1936.** [Remarkable fungous diseases in the year 1936.]—*Kranke Pflanze*, xiv, 9, pp. 141–144, 1 pl., 1937.

The spring of 1936 was marked by the epidemic occurrence in German horticultural establishments of a number of fungous diseases ordinarily causing little or no damage, among which the following may be mentioned. Tulip 'fire' (*Botrytis*) [*tulipae*: *R.A.M.*, xvi, p. 43] was prevalent on outdoor tulips, while peonies and snowdrops were attacked by *B.* [*paeoniae*: ibid., xv, pp. 99, 733] and *B.* [*galanthina*: ibid., xv, p. 442], respectively. Lilies of the valley [*Convallaria majalis*] were extensively damaged by anthracnose, due to a species of *Gloeosporium*. *Heterosporium gracile* [? *Didymellina macrospora*] was responsible for

severe injury to iris and gladiolus plantings [ibid., xvi, p. 751], the blackening of carnations (*H.* sp.) caused heavy losses, while species of the same genus occurred on exceptional hosts, such as *Funkia* and *Polygonatum*. Gladioli were also infected by *Septoria* [*gladioli*: ibid., xvi, p. 563], azaleas [*Rhododendron*] (especially the Petrick varieties) by *S. azaleae* [ibid., xiii, p. 207], phlox by *S. phlogis* [ibid., xvi, p. 256], and privet by *S.* sp. and *Myxosporium cingulatum* [*Gnomonia cingulata*: ibid., v, p. 493]. A very serious disease of *Primula malacoides* was caused by *Ramularia primulae*, not previously observed in the writer's experience on this host though common on outdoor primulas. All varieties suffered equally, and practically every leaf bore rapidly spreading, irregular, brown blotches covered on both surfaces with the pale grey to purple mycelium of the fungus. Successful control of *Gloeosporium limetticolum* [? *Colletotrichum gloeosporioides*] on valuable old citrus trees was achieved by drastic pruning, removal and destruction of diseased material, and preventive treatments of the sound wood and foliage with Wacker's Kupferkalk [ibid., xvi, p. 230] with the addition of tezet [ibid., xv, p. 580] as a spreader.

K. (H.). **Ueber Krankheiten in Baumschulpflanzungen, die durch Bodenverhältnisse verursacht werden.** [On diseases in tree nursery plantings caused by soil conditions.]—*Blumen- u. PflBau ver. Gartenwelt*, xli, 37, p. 431, 1937.

A planting of roses grafted on *Rosa rubiginosa* and *R. canina* suddenly developed a disease characterized by blackish spots, about 3 cm. in length, girdling the stems from the site of insertion of the buds downwards. At first infection was restricted to the cambial layers, but before the buds opened it had completely permeated the tissues so that the stems wilted and the buds collapsed. The fungus responsible for the disease was identified at the Geisenheim [Rhine] Phytopathological Experiment Station as *Diplodia rosarum* [*R.A.M.*, xiii, p. 9], a comparatively rare pathogen occurring only on plants in poor soils. In the case under observation the infection passed in the form of transverse bands through the field, sparing the bushes on the high ground at either end. Notes on the malnutrition of other plants are also given.

Ogilvie (L.). **Some experiments with Lilies.**—*Lily Yearb. R. hort. Soc.*, vi, pp. 106–108, 1937.

Cylindrocarpon radicicola has been reported to cause a root and bulb rot of lilies in Holland [*R.A.M.*, xi, p. 243], but in experimental inoculations on 14 plants at the Long Ashton Research Station, Bristol, with four strains of the fungus isolated from *Lilium longiflorum* and *L. duchartrei* no infection resulted. Most of the rotting of the roots of lilies is thought probably to be due to waterlogging and other adverse soil conditions.

Schneiders (E.). **Über Abbau und Viruskrankheiten der Kulturpflanzen unter besonderer Berücksichtigung der Viruskrankheiten an Dahlien.** [On degeneration and virus diseases of cultivated plants with special reference to the virus diseases of Dahlias.]—*Gartenflora*, lxxxvi, 9, pp. 199–202, 2 figs., 1937.

Following a general review of the nature, etiology, and symptoms of degeneration and virus diseases of cultivated plants, the writer discusses the virus disorders of dahlias occurring in Germany, viz., stunt [*R.A.M.*, xiii, p. 99], mosaic [ibid., xiv, p. 634], ring spot [ibid., xiii, p. 492], spotted wilt [ibid., xv, p. 444; xvi, p. 285], and (?) streak [ibid., xiii, p. 516].

Stunt belongs to a group of degeneration and virus diseases, which comprises such disorders as arise only as a reaction to unfavourable environmental factors. Transverse sections of 150 μ in thickness through the basal shoots contain at least one intracellular cordon [ibid., xvi, p. 622], while phloem necroses are also typical. The leaves of the stunted axes (rosette formation) are abnormally dentate and largely asymmetrical; the glassy aspect of the veins and their prominent mottling are plainly apparent in transmitted light. Severely diseased plants do not flower. Other features of stunt in fairly vigorous plants include the development of internodes of irregular length and structural changes in the shoot axis.

Mosaic, ring spot, and spotted wilt represent purely infectious diseases, in which the action of the pathogenic agent is expressed in chlorophyll defects and abnormalities in leaf shape. Intracellular cordons are not characteristic of these disturbances. Owing to the paucity of material it has so far been impossible definitely to identify the greyish-brown, necrotic streaks on the petioles as manifestations of streak disease.

Brief, practical indications are given for the control of diseases of the foregoing types.

Lewis (Esther A.). **Some fungous diseases of Clarkia elegans.**—*Phytopathology*, xxvii, 9, pp. 951–953, 1937.

In a perusal of the relevant literature the writer found only two records of fungi on *Clarkia elegans*, i.e., *Vermicularia clarkiae* Fautr. on the leaves and *Cytosporella clarkiae* Oud. on the stems, both from Europe [but see *R.A.M.*, xiv, p. 678]. *Puccinia clarkiae* Peck and *Synchytrium fulgens* [ibid., xv, p. 524] were found on herbarium material from California, where the plant occurs as a native annual. The following fungi (in addition to five apparently non-pathogenic species) were found on diseased plants and inoculated into healthy seedlings with positive results: *Alternaria tenuis*, *Botrytis cinerea*, *Citromyces griseus*, *Cladosporium elegans*, *Fusarium* sp., *Helminthosporium* sp., *Hormodendrum cladosporioides* [see above, p. 84], *Oospora epilobii* (Cda) Sacc. & Vogl., *Penicillium* [*Scopulariopsis*] *brevicaule*, *Peronospora arthuri* Farl., *Pleospora herbarum*, *Pythium de Baryanum*, and *Verticillium albo-atrum*.

Becker. **Schon im Herbst Kleekrebs-Bekämpfung.** [Begin with Clover rot control in the autumn.]—*Dtsch. landw. Pr.*, lxiv, 36, p. 437, 1937.

Clover rot [*Sclerotinia trifoliorum*: *R.A.M.*, xvi, p. 754] is stated to be widespread in the Eutin district [Oldenburg], where it chiefly affects the red and crimson varieties [*Trifolium pratense* and *T. incarnatum*] and lady's finger [*Anthyllis vulneraria*], though yellow and alsike [*T. agrarium* and *T. hybridum*] are also susceptible, while white clover

[*T. repens*] is resistant. In the very snowy winter of 1928–9 the fungus was present in all the 83 clover stands inspected, causing losses ranging from 20 to 80 per cent. in about half the number. One of the best means of combating the disease is to keep the stands well grazed, tall, straggling plants being much more liable to attack. *S. trifoliorum* predominates in light soils, where the plants cannot easily take root; rooting may, however, be assisted by rolling in the spring and autumn and by sowing clover among winter instead of summer cereals, barley being particularly favourable for this purpose.

Henson (L.) & Valleau (W. D.). **Sclerotium bataticola Taubenhaus, a common pathogen of Red Clover roots in Kentucky.**—*Phytopathology*, xxvii, 9, pp. 913–918, 2 figs., 1937.

An account is given of the writers' studies on the fungus responsible for red clover [*Trifolium pratense*] root blackening in Kentucky, with special reference to their reasons for retaining the name *Sclerotium bataticola* [*R.A.M.*, i, p. 36; iii, p. 248; iv, p. 350; v, p. 451; vi, p. 757] for the organism in preference to *Rhizoctonia bataticola* (of which *Macrophomina phaseoli* is a pycnidial strain) [ibid., xvi, p. 658].

In pure culture all the strains of the fungus isolated from clover plants of different varieties, two months to two years old, produced hyaline, profusely branched hyphae without clamp-connexions and formed sclerotia in 36 hours to three days, according to the type of mycelial growth; these organs are smooth, black, spherical, oblong, oval, or curved, and measure 61 to 150 μ on dead clover crowns, 57 to 145 μ on pepper [*Capsicum*] fruits, and 70 to 242 μ on 2 per cent. potato dextrose agar. No pycnidia were observed on any of the media used. Potato dextrose agar and potato plugs are often coloured vinaceous to mineral red (Ridgway). Cultures of *S. bataticola* from California and North Carolina were morphologically indistinguishable from the Kentucky clover material. The fungus was mildly pathogenic to red clover in soil inoculation experiments in the greenhouse.

After briefly summarizing the literature on the taxonomy of *M. phaseoli*, the writers point out that the clover fungus presents closer affinities with the Ascomycetes than with the Basidiomycetes. There is no evidence of clamp-connexion formation, and the type of branching on which it was presumably first identified as a *Rhizoctonia* (inception at right angles to the parent hyphae, constriction at the site of origin) is not a reliable character for the separation of Basidiomycetes from Ascomycetes. Ample proof seems to be forthcoming that *S. bataticola* sometimes produces pycnidia of the common Ascomycete type, whereas these organs are extremely rare, if not altogether lacking, in the true Basidiomycetes. In view of these considerations the use of the name *S. bataticola* instead of *R. bataticola* for the sclerotial strains of *M. phaseoli* is advocated.

Lupinenwelke und ihre Bekämpfung. [Lupin wilt and its control.]—*Dtsch. landw. Pr.*, lxiv, 38, p. 463, 1937.

Considerable difficulty is presented by the problem of combating the fungal wilt of lupins [associated primarily with *Thielaviopsis basicola*: *R.A.M.*, xvi, p. 539], which is causing steadily increasing losses in this

important German fodder crop. In the Potsdam district the disease occurs on light soils of superior constitution bearing lupins for the first time, so that the existence of alternate hosts of the fungus is obvious. Yellow lupins [*Lupinus luteus*] suffer most severely from the wilt, but the blue [*L. angustifolius*] are also liable to infection. Weather conditions, time of sowing, and age of the plants appear to play no decisive part in the development of *T. basicola* on lupins, and seed treatment offers little hope of success owing to the persistence of the organism in the soil. Varietal selection trials have been planned by the local plant protection authorities in co-operation with the Biological Institute.

Cormack (M. W.). **Cylindrocarpon ehrenbergi Wr., and other species, as root parasites of Alfalfa and Sweet Clover in Alberta.**—*Canad. J. Res.*, xv, 9, pp. 403–424, 1 pl., 2 figs., 1 graph, 1937.

The results of continued investigations of the root rot of lucerne and sweet clover [*Melilotus* spp.] in Alberta showed that, apart from *Plenodomus meliloti* and *Sclerotinia* sp. [*R.A.M.*, xv, p. 445], *Cylindrocarpon ehrenbergi* Wr. [ibid., xvi, p. 298] is probably one of the most important parasites associated with the condition. This fungus was isolated from a large proportion of the diseased roots collected from widely separated points throughout the province, both in virgin and cultivated soils. In artificially inoculated soil it was shown to begin invading the uninjured host roots at the earliest sign of thawing in the soil, either directly through the unwounded cortex or through the lenticels or the basal tissues of the lateral roots. The lesions on the roots at first have a watersoaked appearance; they soon increase in size and finally turn dark brown; in severe cases the entire root system decays within a week or two from the first sign of infection. Another type of injury frequently caused by *C. ehrenbergi* in the early spring is crown rot, the plants dying when the crown buds are destroyed. Sweet clovers usually suffer more than lucerne from the attacks of the fungus, but the degree of infection varies greatly from year to year. Natural infection of the roots of both crops was rarely observed during the growing season, and infection from artificial inoculations of the roots was much less severe later in the season than in the early spring.

Studies of 35 isolates of *C. ehrenbergi* showed that they differed in their pathogenicity to sweet clover and lucerne, and gave indications of host specialization; they also differed markedly in morphological and cultural characteristics which, however, did not appear to be correlated with parasitism. In pure culture *C. ehrenbergi* grew at temperatures ranging from −2° to 32° C., the optimum varying, however, from one isolate to another. Isolates with an optimum at about 19° caused the most damage in the early spring, while a strain growing best at 24° proved to be the most virulent during summer. While the optimum hydrogen ion concentration for growth varied with the medium employed, growth and spore germination studies indicated that the isoelectric point for the fungus lies at approximately P_H 5·1. *C. ehrenbergi* was also shown to be pathogenic to roots of *Trifolium* spp.

Isolations from diseased lucerne roots occasionally also yielded *C. obtusisporum* [ibid., xvi, p. 822], *C. olidum* [ibid., xv, p. 605], and *C. radicicola* [ibid., xvi, p. 813]: the last-named was also obtained from

sweet clover roots, and the first-named from diseased raspberry roots. It was experimentally shown that *C. obtusisporum* is slightly to moderately pathogenic, *C. radicicola* is very weakly so, and *C. olidum* is not pathogenic. No species of *Cylindrocarpon* was isolated from the seeds of lucerne and sweet clover.

Further experiments showed that most of the commonly grown varieties of lucerne and sweet clover are susceptible to attack by *C. ehrenbergi*, but resistant species like *Medicago falcata* may prove valuable for breeding resistant forms. It is suggested that severely infected lucerne and sweet clover fields should be cropped for several years with cereals, which apparently are not attacked by *C. ehrenbergi*.

Bratley (C. O.). **Incidence and development of Apple scab on fruit during the late summer and while in storage.**—*Tech. Bull. U.S. Dep. Agric.* 563, 45 pp., 11 figs., 4 graphs, 1937.

This detailed study on the development of *Venturia inaequalis* on stored apples [*R.A.M.*, xiv, p. 111; xvi, p. 263, *et passim*] and in the orchard was made on account of disputes arising between storage managers and owners of fruit in the United States regarding the responsibility for scab development in storage. Cultural experiments showed that the fungus can grow at 32° F., the usual storage temperature. In early summer lesions and fruit enlarge *pari passu* but in late summer the enlargement of the lesions proceeds much more rapidly than that of the fruit. In commercial storage only a small percentage of old lesions enlarge, and the usual increase in diameter amounts to only 1 or 2 mm. The number of new lesions appearing during storage varies greatly with the season and place of origin and may be commercially important. The greatest enlargement of lesions occurs on fruit packed while wet in tight boxes, but in other respects the type of storage container has little effect on the development of the disease; in open containers the lesions often decrease in size. The source of the fruit has much more effect on the development of lesions in storage than have slight variations in orchard practice. When relative humidity in storage is constant, greater enlargement of lesions occurs at 40° than 32°, but at a constant storage temperature increase in relative humidity promotes greater enlargement of the lesions. Lesions may appear at any time during storage, in some cases becoming visible after the normal storage life. When scabby and clean fruit from the same tree are stored together the number of lesions appearing on the former is increased. In natural infections more new lesions appear on the stem half of the fruit than elsewhere, but inoculation experiments failed to demonstrate any difference in susceptibility between the stem and blossom-end halves, or between blush and green areas. No macroscopic differences were noted that indicated which lesions would subsequently enlarge during storage; if a strip of dark fungus remains at the edge, even lesions well corked-off may enlarge. In general, there was no difference in appearance between lesions that had enlarged during storage and those that had not; the mycelium in both was much darker than in orchard lesions. When fruit was held at temperatures above 40° or for a long period at 32° the fungus ramified rapidly through the surface flesh without visibly affecting the cuticle. Lesions

appearing on McIntosh fruit during storage are often quite similar to orchard lesions, but are usually darker, while on very ripe fruits they are jet-black and do not break the cuticle. Similar lesions were found on Baldwin fruits.

Apples were successfully inoculated throughout their development on the tree and even after picking, but in no instance were inoculations of mature apples successful when followed immediately by storage. All attempts to obtain spread of infection from affected to clean fruit were unsuccessful. Infections developing during storage would appear to have originally occurred on the tree.

Apples inoculated in the middle of August and submitted to moist conditions for 28 hours did not become infected, whereas those exposed for 40 hours developed numerous lesions. Increasingly long wet periods become necessary for infection as the fruit develops. The shortest and longest periods of latency on inoculated fruits were 23 days and 6½ months, respectively. In each of three years the latest natural inoculations occurred about the middle of August; some of the resultant infection appeared in storage.

KEITT (G. W.) & PALMITER (D. H.). **Potentialities of eradicant fungicides for combating Apple scab and some other plant diseases.**—*J. agric. Res.*, lv, 6, pp. 397-437, 2 figs., 4 graphs, 1 plan, 1937.

This is a full report of the results obtained so far in the work which has been prosecuted since 1924 in Wisconsin for the purpose of testting the possibility of controlling apple scab (*Venturia inaequalis*) by chemical methods aiming at the immunization of the host or the eradication of the parasite [see below, p. 121]. The more important of these results have already been noticed in this *Review* from an abstract in another publication [*R.A.M.*, xvi, p. 470].

An account is further given of small-scale exploratory tests on the potentialities of copper-lime-arsenic mixtures for the suppression of primary inocula in relation to eight other plant-pathogenic fungi, most of the results of which have also been already noticed from another source [ibid., xv, p. 2]. It is also stated that dormant spraying with some of the mixtures was also highly effective against the sclerotia, mycelia, and basidiospores of *Corticium koleroga* causing thread blight of the fig (*Ficus carica*), and partly effective in suppressing the production of pycnospores of *Phyllosticta solitaria* on apple, and of conidia of *Cladosporium carpophilum* on peach. It is stressed, however, that the studies have not yet reached a stage warranting large-scale trials of any of the methods discussed in this paper.

There was clear evidence that the toxicity of the copper-lime-arsenic mixtures to both host and parasite can be varied through a wide range by the choice of the arsenical component, modifications in the amounts and proportions of the ingredients, and the use of amendments. It was shown that the preparations liberate soluble materials capable of diffusing through acid, neutral, or alkaline media, and of exercising fungicidal action at considerable distances from the undissolved residues. Suitable mixtures are highly effective against the fruiting bodies of the fungi, which develop at the surface, or close to the permeable surface of invaded tissues, a fact which renders many of the plant pathogenic

organisms vulnerable to attack by surface applications of eradicant fungicides.

Burkholder (C. L.). **Spray injury and fruit russet.**—*Hoosier Hort.*, xix, 9, pp. 134–139, 1937.

Sulphur sprays, applied to apple trees in the pre-blossom stage shortly after a dormant treatment with oil, for scab [*Venturia inaequalis*] control, may cause very severe injury under Indiana conditions. According to F. Beach, of Ohio University, this type of damage may be greatly reduced or eliminated by the addition of 2–6–100 Bordeaux to the dormant oil spray mix, which should be given as long as possible before the first scab treatment.

Lime-sulphur burn [*R.A.M.*, xvi, p. 189, *et passim*] falls into two categories, associated with (1) slow drying in damp weather, and (2) high temperatures. In the case of (1) the adverse effects of the treatment may be minimized during the pre-blossom period by reducing the liquid lime-sulphur to 2 or 3 qts. per 100 gals. and adding 4 to 6 lb. wettable sulphur, while in that of (2) the substitution of wettable sulphur for liquid lime-sulphur from the calyx spray onwards is recommended.

Bordeaux mixture is very effective against scab when applied during blossoming [ibid., xvi, p. 188], at which stage it is also less liable to cause russeting under humid conditions than later. The Jonathan and Ben Davis varieties are very liable to russeting through unfavourable weather conditions early in the season, while Rome is resistant both to weather and spray injury. Golden Delicious is very difficult to produce with a good finish, and should be treated with wettable sulphur from the petal-fall spray onwards, while Stayman and Grimes are also very susceptible to foliage and fruit injury.

Woodbridge (C. G.). **The boron content of Apple tissues as related to drought spot and corky core.**—*Sci. Agric.*, xviii, 1, pp. 41–48, 1937.

A tabulated summary is given of experiments carried out in British Columbia, the results of which established the existence of a definite correlation between low boron content in apple tree tissues (one-year-old twigs, mature leaves, and mature fruits) and a high incidence of drought spot and corky core [*R.A.M.*, xvi, p. 819], and also showed a correlation between high boron content and absence of disease. The twigs of entire healthy trees contained at least 14 p.p.m. boron, while those from diseased trees contained less than 10 p.p.m. Some disease may be expected in trees with a boron content between these two figures.

Analyses of soil taken at depths varying from 12 to 24 in. at distances of approximately 6 ft. from the trees gave a definite correlation between high boron content and absence of disease, but where the boron content of the soil was low, as was found around all the control trees receiving no applications of boron, some of the trees being healthy and some diseased, no correlation existed. It is possible, however, that the method used in making soil extractions did not bring into solution all the boron available to the trees, or another explanation may be that trees which had suffered from heavy rootlet injury had been weakened in their ability to assimilate boron from the soil.

Rives (L.). **Sur l'apoplexie du Prunier de Burbank et de l'Abricotier.** [Note on the apoplexy of the Burbank Plum and of the Apricot.] —*Progr. agric. vitic.*, cviii, 32, pp. 125–128, 2 figs., 1937.

The author states that isolations from the diseased tissues of the Burbank plum presenting symptoms of apoplexy as described by him in a previous communication [*R.A.M.*, x, p. 529], yielded yellow and white strains of bacteria, the identity of which is still under investigation. Inoculations in September, 1932, into one-year-old Burbank plums, grafted on myrobalan [*Prunus divaricata*] stocks, either with the yellow organism alone or with a mixture of the two strains, reproduced the condition, and led to the death of all the inoculated trees in September, 1934. Apricots similarly inoculated remained healthy. The suspected identity of the yellow strain with *Bacillus amylovorus* [*Erwinia amylovora*] has not been substantiated.

McWhorter (O. T.). **Peach twig blight active in Oregon.**—*Bett. Fruit*, xxxii, 2, p. 10, 1937.

Peach twig blight and fruit spot [*Clasterosporium carpophilum*] has been a serious disease in Oregon since 1906, production being frequently impossible in the Willamette Valley unless spraying is carried out annually; it is also destructive in eastern Oregon. Apricots are also severely affected, part of the 1937 crop being unmarketable as a result of infection, which occurs in other north-western states besides Oregon.

Control consists in spraying with Bordeaux mixture 4–4–50 in early autumn before the rains start, the spray being carefully applied to the new growth, including the smallest bud and twig. Later applications serve only to check spread. Peaches may sometimes require a spring application of wettable sulphur at petal-fall to prevent fruit spot following twig blight.

Osterwalder (A.). **Eine wirksame Bekämpfung der Quittenkrankheit.** [An effective control of the Quince disease.]—*Schweiz. Z. Obst- u. Weinb.*, xlvi, 14, pp. 234–238, 2 figs., 1937.

Good control of *Sclerotinia cydoniae* on quinces [*R.A.M.*, xii, p. 488] in Switzerland was obtained in recent experiments by two to three applications of Bordeaux mixture during the blossom.

Galang (F. G.) & Lazo (F. D.). **The setting of Carabao Mango fruits as affected by certain sprays.**—*Philipp. J. Agric.*, viii, 2, pp. 187–210, 2 figs., 3 graphs, 1937.

Studies carried out in the Philippine Islands on the effects of certain sprays on the setting of Carabao mango fruits showed that in 1934–5 the plants sprayed with fungi-bordo gave 0·00947 per cent. setting, while in the following season the figure was 0·11933 per cent., the settings in the unsprayed controls being 0·02745 and 0·20348 per cent., respectively. The best settings were given by lime-sulphur (7 spoonfuls to 5 gals. of water) with 0·06389 per cent. setting in the 1934–5 experiment and 0·15674 (control 0·08378) per cent. setting in 1935–6. Spraying with rain- or tap water reduced setting as compared with the unsprayed controls.

Wager (V. A.). **Mango diseases in South Africa.**—Reprinted from *Fmg S. Afr.*, xii, 4 pp., 7 figs., 1937.

In these notes on the symptoms and control of the principal diseases of mangoes in South Africa it is stated that bacterial black spot (*Bacillus mangiferae*) [*Erwinia mangifera*: *R.A.M.*, xiii, p. 174] usually becomes noticeable in the Transvaal after the first November rains, spreading rapidly if an appreciable amount of rain falls during the next two months. In dry seasons the disease causes little damage. Losses may be materially reduced by four to seven very thorough applications of Bordeaux mixture used at standard strength with a spreader added and given as soon as the lesions appear, and afterwards once a fortnight during dry weather, and immediately after every rainstorm until the middle of January. On some large trees spraying has increased the yield of clean fruits, as compared with the unsprayed controls, by 80 per cent. The control of anthracnose or ripe rot (*Colletotrichum gloeosporioides*) [ibid., vi, p. 288] also depends on orchard applications of Bordeaux mixture, treatments of picked fruit having practically no effect, as the fungus apparently enters the pores of the fruit while it is still green, and develops in the flesh during ripening. The discoloration due to sooty blotch (*Gloeodes pomigena*) [ibid., xiv, p. 426] reduces the commercial value of the fruit, which should be dipped for two minutes in a bleaching solution of $\frac{1}{4}$ lb. each of chloride of lime and boracic acid per gal. of water [cf. ibid., xiv, p. 754], afterwards being washed in clean water and stacked to dry. The disease is unlikely to appear in sprayed orchards. Mildew (*Erysiphe cichoracearum*) [ibid., xiv, p. 426] has in recent years become widespread and patchy in the Eastern Transvaal. Some trees may set no fruit as a result of infection, while others in close proximity may bear a good crop. A hot, dry spring with heavy dews nightly conduces to severe outbreaks; in two experiments sulphur dusting [ibid., x, p. 326] gave rather inconclusive results. If the blossoms are seriously attacked spraying with Bordeaux mixture should be begun at the peak of the flowering period and repeated a fortnight later.

Palmiter (D. H.) & Keitt (G. W.). **The toxicity of copper-lime-arsenic mixtures to certain phytopathogenic fungi grown on malt agar plates.**—*J. agric. Res.*, lv, 6, pp. 439–451, 3 figs., 1 graph, 1937.

In addition to the information contained in the preliminary account of this work, which has been noticed from another source [*R.A.M.*, xiv, p. 381], it is stated that the toxicity of the copper-lime-arsenic mixtures studied, and of their separate ingredients, was tested on the following plant-pathogenic fungi, namely, *Venturia inaequalis*, *V. pirina*, *Cladosporium carpophilum*, *Phyllosticta solitaria*, *Elsinoe veneta*, *Glomerella cingulata*, *Physalospora obtusa*, and *Sclerotinia fructicola*, all of which proved to be highly susceptible to the action of suitable mixtures [see above, p. 118]. Monocalcium arsenite was the most toxic of the arsenical compounds tested, usually three to more than ten times as toxic as copper sulphate, depending on the fungus used. Tricalcium arsenite was slightly less toxic than monocalcium arsenite, and zinc and iron arsenite were of comparatively low toxicity, while Paris green and

copper arsenite were intermediate. Tricalcium arsenate was the least toxic of all, and dicalcium arsenate showed but slightly higher toxicity.

MacLeod (G. F.) & Sherwood (H. F.). **Grenz radiographs of sulfur dispersion on foliage.**—*J. econ. Ent.*, xxx, 3, pp. 395–399, 2 figs., 1 diag., 1937.

The need for a rapid and accurate method of depicting sulphur residues on foliage led to preliminary tests with Grenz-ray radiography at the Eastman Kodak Research Laboratories, Rochester, New York. Baldwin apple leaves were sprayed in the laboratory with mixtures of 14 gm. 325-mesh unconditioned pure sulphur in solutions of (1) 2 gm. 13 per cent. soap water, (2) 2 gm. areskap dry 100 [*R.A.M.*, xvi, p. 196], and (3) 2 c.c. mouillant M (an alkyl-aromatic sulphate), as wetting agents in 1,000 c.c. distilled water. After six hours' drying one half of the sprayed surface was coated with a waterproof lacquer which dried in half an hour and the leaves were then completely submerged for 30 seconds in a bath of distilled water. After this 'artificial weathering' the leaves were again dried and coated with lacquer to preserve any spray material surviving the 'weathering' and photographed by Grenz (soft X-ray) radiation. By these means it was shown that larger amounts of sulphur are retained both on the upper and lower surfaces of leaves sprayed until they dripped than on those sprayed until one drop formed. Heavier initial deposits also resulted in a higher degree of resistance to 'weathering'. In all cases the lower surfaces retained more sulphur than the upper ones. Mouillant M deposited the largest amounts of sulphur on the under sides of the leaves and soap the smallest, much of which was also lost through 'weathering'.

Yarwood (C. E.). **Sulphur and rosin as downy mildew fungicides.**—*Phytopathology*, xxvii, 9, pp. 931–941, 1 fig., 1 diag., 1937.

In order to test the toxicity of sulphur dust (flottox) to the sporangia of onion downy mildew (*Peronospora destructor*) [*P. schleideniana*: *R.A.M.*, xvi, p. 651], these organs were added in the form of a suspension to glass slides and as an atomized spray to plates of agar, both dusted with the fungicide. The preparations were incubated in the dark at 10° C. in one test, at 19° in another, and at 22° in two further trials. After 24 hours germination in four tests on the sulphur-dusted slides was 75, 78, 69, and 83 per cent., respectively, the corresponding figures for untreated control slides being 95, 93, 64, and 86 per cent., respectively; there was no germination on the dusted agar plates, and 91, 92, 51, and 84 per cent., respectively, on the controls. In another test, small heaps of sulphur dust and drops of a water suspension of it were applied to localized areas on plates of cold agar prior to dusting with the mildew sporangia, no germination of which occurred for a distance of 1·3 mm. from the edge of the sulphur.

The toxicity of lime-sulphur, copper sulphate, and rosin [ibid., viii, p. 655] solutions was tested by adding sporangial suspensions to solutions of known strength and placing drops of this suspension on glass slides or atomizing them on plates of agar. The minimum concentrations at which spore germination was inhibited were 1 in 10,000 for lime-sulphur on slides and agar plates, 1 in 100,000 for copper sulphate

on both, 1 in 10,000 for rosin on slides, and 1 in 1,000 for the same on agar plates. These results indicate that sulphur dust, lime-sulphur, and rosin are all moderately toxic to the sporangia of *P. schleideniana*, but not in the same degree as copper sulphate, their efficacy being furthermore largely dependent on the substratum.

The distribution of Bordeaux and lime-sulphur sprays without spreaders is poor on onion foliage; by the addition of penetrol [ibid., xvi, p. 797] to the former and sodium oleyl sulphate [ibid., xv, p. 781] to the latter in appropriate quantities the covering properties of the sprays were enhanced, the amount of fungicide deposited on the leaf surface substantially reduced, and the protective action increased. On hop and bean [*Phaseolus vulgaris*] leaves, which are much less difficult to wet than those of onions, the initial spray deposit was heavier and the effect of the spreaders correspondingly less noticeable.

In greenhouse and field tests 1 per cent. Bordeaux+0·05 per cent. penetrol, 2 per cent. lime-sulphur+0·05 per cent. sodium oleyl sulphate, and rosin alone or with lime-sulphur in varying proportions, gave satisfactory control of *Peronospora schleideniana* on Prizetaker onions and also of hop downy mildew [*Pseudoperonospora humuli*: ibid., xvi, p. 836]. Onions sprayed with rosin-lime-sulphur and exposed to known amounts of rain before inoculation with the downy mildew fungus generally resisted infection, whereas Bordeaux mixture, rosin alone, or lime-sulphur alone failed to exert a comparable protective action. Onions for seed yielded more abundantly and showed less infection when treated with lime-sulphur than when sprayed with Bordeaux or rosin; in the case of plants for greens the best results were obtained with rosin-lime-sulphur.

Lime-sulphur (2 per cent.)+0·05 per cent. sodium oleyl sulphate or 1 per cent. rosin effectually prevented the over-night sporulation of *P. humuli* and *Peronospora schleideniana*, the rosin combination being particularly successful, whereas Bordeaux, sulphur dust, and rosin alone failed in this respect. Judging by the outcome of these experiments as a whole, rosin-lime-sulphur was the most efficacious of the fungicides tested both from the standpoint of protection against disease and weathering and from that of increased yield.

Camenzind (P.). **Neuer Erdsterilisierapparat.** [A new soil sterilization apparatus.]—*Blumen- u. PflBau ver. Gartenwelt*, xli, 37, p. 428, 1 fig., 1937.

A note is given on the construction of the 'Pronto' soil sterilization apparatus [cf. *R.A.M.*, xvii, p. 51], which is stated to have been used with excellent results in Switzerland. It consists of a soil container of 25, 40, or 60 l. capacity, into which the steam is introduced from all sides so that the soil reaches the necessary temperature of 95° to 100° C. in 7 to 15 minutes.

Shewell-Cooper (W. E.). **A simple yet effective soil steriliser.**—*Parks, Golf Courses & Spts Grnds*, ii, 12, pp. 334–336, 4 figs., 1 diag., 1937.

Details are given of the construction of the Reaseheath sterilizer, consisting of a long shallow trough of brickwork (23 ft. by 3 ft. 1½ in.

by 1 ft. 2 in. deep) capable of holding several tons of soil built over four flues divided by thin vertical walls, with a fire-box at one end and chimney at the other, a rise of 9 in. being made in the trough towards the chimney end. Using coke as fuel the temperature of the soil is raised to an average of 205° to 210° F. in eight hours, thick sacking being used to cover the soil to conserve the heat. After baking for four hours the soil is double dug and heated for four hours more.

KIENHOLZ (J[ESS] R.). **Isolating single spores without special equipment.**—*Phytopathology*, xxvii, 9, pp. 950–951, 1 fig., 1937.

Details are given of a simple method of isolating single spores, the only special instrument required being a glass transferring rod, heated in a flame and drawn out to a hair, at the extremity of which a small knob is produced by light contact with the base of the flame, the total length of the rod being 3 to 4 in. Transfers from a spore suspension on a slide to marked areas of agar plates are made by means of the knob.

CHESTER (K. S.). **A critique of plant serology. Part II. Application of serology to the classification of plants and the identification of plant products. Part III. Phytoserology in medicine, and general biology. Bibliography.**—*Quart. Rev. Biol.*, xii, 2, pp. 165–190; 3, pp. 294–321, 1937.

This is the continuation and conclusion of the writer's critical studies on recent developments in plant serology, the opening section of which has already been noticed [*R.A.M.*, xvi, p. 698]. The following are the headings under which the subject is discussed in these two instalments: identification of plant products, application to plant systematics, serology of purified or altered plant proteins, serology of plant non-proteins, certain medical aspects of plant serology, application of phytoserology in the study of certain basic biological problems (movement of proteins in plants, investigation of hybrids, contributions to the plant virus problems), and the possibilities and limitations of phytoserology. The supplementary bibliography comprises 392 titles.

Yearbook of Agriculture, 1937.—1497 pp., 327 figs., 1 graph, 17 maps, Washington, D.C., United States Department of Agriculture, 1937. Price $2.

This yearbook is complementary to the volume published in 1936 [cf. *R.A.M.*, xvi, pp. 62, 82] and, with it, aims at presenting, in a series of papers by specialists, a national and, to some extent, an international survey of practical breeding work and genetic research with plants important to American farming. The present work covers an enormous field, dealing as it does with garden vegetables, northern tree and bush fruits, sub-tropical fruits, flowers, nut trees, forest trees, and forage grasses and legumes, as well as animals, bees, and poultry. Disease resistance figures largely as an aim in American breeding work, and is discussed in some detail in the various sections, which are supplemented with basic data and tables including, *inter alia*, lists of plants with superior germ-plasm for various characteristics available for breeding work. Recent achievements in this field include the wilt [*Fusarium bulbigenum* var. *lycopersici*] -resistant Marglobe tomato variety [ibid.,

xvi, p. 782], which saved the Florida growers from ruin, cantaloupe strains resistant to powdery mildew [*Erysiphe cichoracearum*: ibid., x, p. 431], strains of lettuce and snap beans [*Phaseolus vulgaris*] resistant to several of the chief diseases affecting these crops, and cabbages resistant to yellows [*Fusarium conglutinans*: ibid., xvi, p. 159].

Some aspects of the plant disease eradication and control work of the Bureau of Entomology and Plant Quarantine.—*Plant Dis. Reptr, Suppl.* 99, pp. 17–46, 1937. [Mimeographed.]

Notes are given on the progress made in the United States during 1936 in the eradication campaigns against various diseases.

O. N. Liming states that in the Dutch elm disease [*Ceratostomella ulmi*: *R.A.M.*, xvi, pp. 645, 782] centres outside the major area of infection [cf. ibid., xv, p. 692] not one tree became affected, and the number of diseased trees in eight localities in New York state and New Jersey amounted to 127, as against 477 in 1935 and 1,115 in 1934.

S. B. Fracker states that about 196,211,187 *Ribes* bushes over an area of 3,829,890 acres were eradicated during 1936 in the course of the campaign against *Cronartium ribicola* [see below, p. 143]. The disease caused great damage to *Pinus lambertiana* in the vicinity of Panther Mountain, Oregon [ibid., xvi, p. 74], where it appears to have been present for 10 years; the trees showed practically 100 per cent. infection, pines up to 8 in. in diameter and 70 years of age succumbing. About 21 per cent. of the area has already been subjected to eradication methods. In 1936, 85,385 cultivated black currant bushes were destroyed in the Lake States.

During the same period over 68,500,000 *Berberis* bushes were destroyed in the campaign against wheat stem rust (*Puccinia graminis*). Among the new chemicals tested for eradication purposes atlacide applied as a spray and as a soil drench at the rate of 8 lb. in 5 gals. of water to each square rod was very effective.

According to B. M. Gaddis over 21,000,000 peach trees were inspected for phony disease [ibid., xvi, p. 329] in 20 States during 1936, 156,977 diseased trees being found and 146,072 removed. All infected trees will probably have been removed from all States except Georgia by the end of 1936. The disease was found for the first time in Indiana and Pennsylvania.

In the campaign against *Bacterium* [*Pseudomonas*] *citri* over 13,600,000 citrus trees were eradicated between 1st July, 1935 and 31st December, 1936 [ibid., xvi, p. 192].

Atanasoff (D.). **Virus diseases of plants: a bibliography. I. Supplement.**—*Phytopath. Z.*, x, 4, pp. 339–463, 1937.

This first supplement to the writer's bibliography of the virus diseases of plants [*R.A.M.*, xiii, p. 530] comprises a large number of further titles of papers issued since that date, arranged under 49 headings with the addition of author and general indexes.

Chester (K. S.). **Serological studies of plant viruses.**—*Phytopathology*, xxvii, 9, pp. 903–912, 1937.

Recent precipitin tests [*R.A.M.*, xvi, p. 767] indicate that Canada

streak of potato is a strain of aucuba mosaic of potato; Blakeslee's Z-mosaic of *Datura* is a strain of the etch group [loc. cit.]; Price's cucumber mosaic isolates are strains of the cucumber mosaic group [ibid., xvi, p. 615], though celery mosaic [ibid., xvi, p. 584], lily mosaic [ibid., xvi, p. 752], and Doolittle's cucumber mosaic juices failed to react with sera for Price's cucumber mosaic; the European Y-virus of potato [ibid., xvi, p. 771] is serologically indistinguishable from the American potato veinbanding virus [ibid., xvi, p. 828], to which stipplestreak [ibid., xvi, pp. 481, 631] is also related; the latter, being ordinarily associated in the field with latent mosaic [ibid., xvi, p. 630], is considered to be a type of rugose mosaic [ibid., xvi, pp. 116, 337, 489].

Tobacco mosaic virus, propagated in root-tissue cultures and locally necrotic lesions, yields specific virus antigen. All the viruses that have so far proved serologically active are placed in the following eight groups according to their relationship reactions: (*a*) tobacco mosaic, (*b*) potato latent mosaic, (*c*) potato veinbanding, (*d*) potato aucuba mosaic, (*e*) etch, (*f*) tobacco ring spot, (*g*) pea mosaic viruses 2 and 3 [see above, p. 90], and (*h*) potato mild mosaic [ibid., xv, p. 459; xvi, pp. 480, 487]. Among the 19 viruses (besides those mentioned above) failing to give serological responses may be mentioned aster [*Callistephus chinensis*] yellows, peach yellows, potato witches' broom, potato leaf roll, potato mild circular mottle, potato yellow dwarf, potato calico mosaic, potato spindle tuber, potato crinkle mosaic (crinkle of Schultz and Folsom), pea mosaic virus 1, bean [*Phaseolus vulgaris*] mosaic, sugar-cane mosaic, sugar beet mosaic, tomato spotted wilt, and crucifer mosaic. Such viruses, in contrast to the serologically positive group, are difficult or impossible to transmit mechanically, relatively unstable *in vitro*, usually inactivated by temperatures below 55° C., and show little tendency to systemic spread in their hosts. Lack of virus antigen in the juice, antigenic inactivity of the virus juice, or instability may be among the factors responsible for the absence of serological reactions in this virus category.

The field method of precipitin testing gave reliable results in the hands of unskilled workers. Data are given and suggestions made for its use as a laboratory procedure, the elimination of artifact reactions, and future extended applications of the technique employed.

Hatch (A. B.). **The physical basis of mycotrophy in Pinus.**—*Black Rock For. Bull.* 6, ix+168 pp., 17 pl., 7 figs., 13 graphs, 1937.

In the first two parts of this paper the author discusses the existent literature (from the beginning) dealing with ectotrophic mycorrhiza [*R.A.M.*, xvii, p. 54] and critically reviews the different theories that have been put forward as to the factors controlling their distribution and abundance. In the third part a large number of experiments are described and the conclusions reached may be summarized as follows. The abundance of mycorrhiza on the roots of pine seedlings in normal forest soils depends on the availability of mineral salts, mycorrhiza being freely produced in the presence of a low availability of nitrogen, phosphorus, potassium, or calcium, or of a lack of balance in their availability. The susceptibility of short roots is induced by a combination

of low or unbalanced concentrations in the vascular plants and high concentrations in the fungus, such as appears typically in soils with low concentrations of nutrient ions. There was no evidence that differences in the mycorrhizal equipment affected growth.

In soil culture experiments with prairie soil lacking mycorrhiza, and with introduced mycorrhiza in parallel series, seedlings in the latter were healthy and contained mineral salts ranging from 86 to 234 per cent. more than plants devoid of mycorrhiza, which were stunted and yellow.

In pure culture studies pine seedlings were readily able to utilize peptone and nucleic acid in the absence of ammonium in the substrates. Mycorrhiza were abundantly produced in a sand substrate with appreciable base-exchange properties and rich in undissolved minerals, but not when the base-exchange capacity was low, and either without insoluble or with dissolved minerals.

Infection by mycorrhizal fungi was ascertained to increase the absorbing surface area of the short roots of pine seedlings by continued elongation, increase in diameter, multiple tip development, increase in the life of the cortex by delaying suberization, and lastly, by the fungi acquiring the surface areas either as (1) a parenchyma-like mantle, (2) individual hyphae extending from the mantle into the soil, or (3) mycelium connected with the mycorrhiza by rhizomorphs.

As a result of his study as a whole the author tentatively puts forward the following views. The symbiotic mechanism increases the absorption of soil nutrients chiefly by physical and relatively non-selective means. The greater absorption capacity of mycorrhizal seedlings is induced by increases in the effective absorbing surface areas of short roots resulting from fungal invasion. In fertile soils with abundant dissolved nutrients mycorrhiza are seldom produced and long root tips are the chief organs of absorption. In infertile soils having few dissolved salts, where the nutrient elements are held in base-exchange compounds, mycorrhizal short roots become numerous, their number and development being inversely proportional to the soil fertility. As the availability of nutrients decreases, mycorrhizal short roots have an increasing share in seedling nutrition, and eventually become the only organs of absorption. That fungi are more efficient than roots in extracting nutrients from rocks and base-exchange materials is attributed primarily to the fact that the surface area to volume ratio is much greater in fungi than roots. Trees depend on symbiotic association with mycorrhiza for their soil nutrients and therefore for their existence in all but the most fertile agricultural soils.

Tverskoy (D. L.). Влияние коротких и ультракоротких радиоволн на грибы и бактерии, патогенные для растений. [Effect of short and ultra-short radio waves on fungi and bacteria pathogenic to plants.]—*Pl. Prot., Leningr., 1937*, 13, pp. 3–28, 1937. [English summary.]

The experiments described in some detail in this paper showed that short (8 to 40 m.) and ultra-short (5·2 to 10 m.) radio waves had a lethal effect on *Bacillus carotovorus* [*Erwinia carotovora*], *Fusarium solani*, *Botrytis cinerea*, *Sclerotinia libertiana* [*S. sclerotiorum*], and *Phytophthora infestans*, dependent on the temperature developed in their substratum

(natural, agar, or salt solutions) under the influence of irradiation, but not when the heat effect was eliminated by water jackets. *In vitro* the micro-organisms were killed at temperatures inside the test-tubes from 45° to 50° C. or higher, the inference being that the temperatures of the substrata were much lower than those developed inside the micro-organisms themselves by the waves. With *E. carotovora* it was also observed that the killing effect was more rapid as the density of the suspensions was greater, but was nil when silk threads dipped in a suspension of the bacteria and dried were directly irradiated. The organism was killed most rapidly when present inside cereal grains.

These results are interpreted as indicating the possibility of using short and ultra-short radio waves for the disinfection of wheat seed-grain infected with loose smut [*Ustilago tritici*], or with *Helminthosporium* and *Fusarium* spp., there being evidence that by increasing the potential of the electrical field, the sterilization of the affected grain may apparently be attained within a very short time (a few seconds). It was further found that exposure of wheat grain in an electrical field to a temperature of 65° C. for two to four minutes only slightly reduced its germinability. Further work is in hand to test the possibilities of this method.

Nisikado (Y.) & Hirata (K.). **Studies on the longevity of sclerotia of certain fungi, under controlled environmental factors.**—*Ber. Ōhara Inst.*, vii, 4, pp. 535–547, 1937.

A fully tabulated account is given of the writers' studies on the longevity of the sclerotia of *Sclerotinia trifoliorum* [see above, p. 114] from *Astragalus sinicus*, *S. libertiana* [*S. sclerotiorum*] from sunflower (*Helianthus annuus*) [*R.A.M.*, xv, p. 167], carrot [ibid., xv, pp. 459, 477] and melon (*Cucumis melo*) [ibid., viii, p. 419], *S. minor* [ibid., xvi, p. 160] from *Chrysanthemum cinerariaefolium*, *S. oryzae* [*Leptosphaeria salvinii*: ibid., xvi, p. 405] from rice, *Hypochnus* [*Corticium*] *sasakii* [ibid., xv, pp. 48, 395] from wheat, and *H. centrifugus* [*C. centrifugum*: ibid., xvi, p. 405] from *Amorphophallus konjac*, all in Japan. The fungi were grown for two to four weeks on steamed rice straw at 24° C. and then transferred to (*a*) incubators at temperatures rising by 5° from 0° to 35°, (*b*) sterilized tap water in test-tubes maintained at various temperatures, and (*c*) the same with 0·5 per cent. sodium chloride instead of water. At monthly intervals two pieces of sclerotia were transferred to malt extract agar at 24°, and their germinative capacity determined.

In all the species tested, viability decreased *pari passu* with rising temperature, only *L. salvinii* and *C. centrifugum* being still capable of germination after four and five months, respectively, in tap water at 35°. The sclerotia of *L. salvinii* in the air-dried (incubator) series retained their viability for three years at under 20°, 10 to 13 months at 25° to 30°, and four months at 35°, the corresponding periods in tap water below 5°, under 20°, and 30° being three years, two years, and one year, respectively. In the case of *C. centrifugum* the sclerotia in the air-dried state survived over two years below 10°, three years at 15° to 25°, 26 months at 25°, 16 months at 30°, and 6 months at 35°, the corresponding figures in tap water being two years at 10° to 25°, 16

months at 30°, and five months at 35°. The sclerotia of *S. trifoliorum* on air-dried rice straw retained their viability for over 18 months at below 20°, 14 months at 25° to 30°, and 4 months at 35°, the corresponding figures in tap water being over 13 months at under 5°, 12 to 14 months at 10° to 25°, and 3 months at 30°. The results obtained with the three above-mentioned strains of *S. sclerotiorum*, though not identical, agreed in the main. In series (*a*) the sclerotia survived for two years or more at 20°, over 14 months at 25°, 10 to 14 months at 30°, and 3 to 4 months at 35°, the corresponding figures for (*b*) being 12 to 14 months at below 20°, 8 to 14 months at 25°, 3 to 5 months at 30°, and under a month at 35°, and (*c*) over a year at below 25°, 4 to 5 months at 30°, and less than a month at 35°. The viability relations of *S. minor*, tested on air-dried rice straw only, resembled those of *S. sclerotiorum*. In series (*a*) the sclerotia of *C. sasakii* were still viable after three years at or below 20°, 26 months at 25°, 16 months at 30°, and 6 months at 35°, the corresponding figures for (*b*) being 3 years below 25°, 22 months at 10°, 12 to 13 months at 15°, 6 months at 25°, 3 months at 30°, and less than a month at 35°. It is apparent from these survival data of the fungus, both in humid and dry conditions, that its elimination from the rice fields presents considerable difficulty.

From the foregoing observations it is evident that the sclerotia of the species of the Basidiomycetous genus *Corticium* are more resistant to adverse environmental factors than those of the Ascomycete *Sclerotinia*. In nearly every case immersion in tap water or brine caused a more rapid loss of sclerotial viability than preservation in an air-dry state.

FRANCKE (H. M.). **Untersuchungen über die Physiologie der pflanzlichen Virose.** [Studies on the physiology of plant viroses.]—*Biochem. Z.*, ccxciii, 1–2, pp. 39–63, 1 fig., 2 diags., 14 graphs, 1937.

A fully detailed account is given of the writer's highly technical experiments to determine, by electro- and colorimetric methods, the hydrogen-ion concentrations of Samson Bashi Bagli tobacco, *Nicotiana glutinosa*, *N. rustica*, *Datura stramonium*, tomato, bean (*Phaseolus vulgaris*), and beet plants inoculated with a weak strain of ordinary tobacco mosaic [*R.A.M.*, xvi, p. 778] in comparison with a corresponding healthy series.

The resultant data denoted a marked tendency to acute alkalosis, intensified buffering (up to 144 per cent. of the normal), especially between P_H 3 and 4, and changes in the titration relations of diseased tobacco and beet plants. Analogous observations apply to tomato, the other member of the susceptible group used in the tests. In the locally resistant category, represented by *N. glutinosa*, *D. stramonium*, and bean, and in *N. rustica*, reacting to infection by systemic necrosis, buffering was intensified at P_H 5. Potentiometric measurements on tobacco plants indicated weak reduction intensity for old, yellow leaves, moderate for stem and lower and middle foliage, strong for roots and upper leaves, and very strong for flowers. The end potentials of mosaic-diseased bean, beet, and tobacco leaves were found to be more positive (^rH 14·0, 4·8, and 7·9, respectively) than those of healthy plants (^rH 8·0, 2·8, and 5·3). The course of the curve for diseased but morphologically uninjured tobacco and beet leaves points to the operation in

these organs of an oxidation reduction system falling within the more positive potential range and absent from, or inactive in, those of healthy plants.

VIENNOT-BOURGIN (G.). **Les déformations parasitaires provoquées par les Ustilaginées.** [The parasitic deformations caused by the Ustilaginales.]—189 pp., 65 figs., 2 graphs, 1 map, Paris, Librairie E. Le François, 1937.

In this book the author describes in considerable detail the results obtained in eight years' study of the parasitism of a number of Ustilaginales.

Tilletia caries on *Triticum* spp. reduces by up to 85 per cent. the number of stems produced and causes dwarfing and modification of the internal structure of the culm, the medulla showing exaggerated development resulting in the formation of a semi-solid stem with thickened nodes filled with a spongy tissue. Leaves and internodes are reduced in number. At ripening the culm bends, and later breaks. Affected stems are highly susceptible to infection by other fungi.

Ustilago nuda f.sp. *tritici* [*U. tritici*: *R.A.M.*, xv, p. 84] attacks the various foliaceous organs of the flower of wheat in turn, and not specially or primarily the ovary. The pistil in a flower that has been otherwise almost completely destroyed can continue development of all its parts.

The author concludes that the formation of the tumours studied depends on the prolonged and continuous activity of the initial generative axes. If these are lacking, localized cellular elements appear, and play the same part. The initial process of deformation is always a stimulation of young and active cellular tissues resulting in the proliferation of complex, characteristic structures with a well-defined exterior contour. Host reaction to the Ustilaginales may lead to the formation of generally superficial, sometimes voluminous tumours. In other cases the deformations affect the whole plant forming proliferations in new or existing tissues, but no apparent tumour. Tumour development always corresponds with chlamydospore formation. The passage from the tissues of the tumour to normal tissues may be either sudden (as with *Tuburcinia* spp. and *U. maydis*) [*U. zeae*] or slow and progressive (stem tumours caused by *Melanotaenium* spp., and leaf lesions due to *U. tritici*). Hyperplasia precedes or results from the formation of a sporogenous plexus. The formation of giant cells occurs under the influence of punctures, or external or internal lesions causing the diffusion of toxins. The appearance of a tumour may affect tissues that do not contribute to the gall formation in which case the whole plant shows a new but homogeneous conformation, or, on the other hand, the infected organ may show a heterogeneous structure due to the gall formation and to a complex organization structurally different from both gall and original tissues.

STELZNER (G.). **Resistenzzüchtung bei Kartoffeln.** [Breeding for resistance in Potatoes.]—*Forschungsdienst*, iv, 6, pp. 261–266, 1937.

An account is given of recent developments in Germany and elsewhere in the work of breeding potatoes for resistance to late blight

(*Phytophthora infestans*) [*R.A.M.*, xvii, pp. 57–61], virus diseases, frost, the Colorado beetle (*Leptinotarsa decemlineata*), and drought, supplemented by a list of disorders to which attention should be urgently directed in the near future. According to field observations [in France] by R. Diehl (*Sélectionneur*, v, p. 81, 1936), the Swedish Imperia variety is resistant to leaf roll [ibid., vii, p. 596], Arran Comrade, Bevelander, Max Delbrück, Triumph, and Roode Star to streak [ibid., xvi, pp. 829, 831; xvii, p. 57], and Bevelander and Noordeling to crinkle mosaic [see above, p. 126].

Findlay (D. H.) & Sykes (E. T.). **The control of Potato blight by spraying and destruction of haulm.**—*J. Minist. Agric.*, xliv, 6, pp. 546–551, 1937.

During the summer of 1936 potatoes in the Marshland area of West Norfolk were widely and severely affected by blight (*Phytophthora infestans*). King Edward potatoes given two applications of Bordeaux mixture in the last week of June and in mid-July yielded 5·86 tons of ware potatoes per acre, as against 6·7 tons for those given a third spraying at the end of July. The passage of the spraying machine reduced the yield of ware potatoes by 1·4 tons per acre, but on an acreage basis loss from this cause diminishes in proportion to increased size of the machine used. Spraying the haulms with sulphuric acid [*R.A.M.*, xvi, p. 555] or copper sulphate four weeks before lifting did not reduce the proportion of blighted tubers in the clamp. The evidence obtained indicated that when infection occurs early and the foliage is being rapidly killed, the destruction of the haulms four weeks before lifting is of little use, and may indeed result in a reduced crop. On the other hand, when the haulms of King Edward potatoes remain green until lifting the greatest amount of tuber blight is to be expected, and haulm destruction three weeks before lifting is of service.

Silberschmidt (K.). **A degenerescencia da Batatinha.** [Degeneration of the Potato.]—*Biologico*, iii, 9, pp. 247–254, 1 pl., 1 fig., 1937.

The author states that in the State of São Paulo, Brazil, potatoes are sown twice a year, from January to March for the summer crop, and in August and September for the winter crop. The first, main sowing is generally made with certified seed tubers imported at heavy cost from Europe, and the second with tubers of the Paraná Ouro [Paraná Gold] and Paraná Branca Cascuda [Paraná White Thick-skinned] varieties imported from Paraná [Argentina]. Phytopathological inspections in two localities showed that crops produced from the Paraná seed tubers contain a high percentage of virus diseases [*R.A.M.*, xvii, p. 57] which, by their external symptoms alone, are tentatively identified as leaf roll, rugose mosaic, a form closely resembling mild mosaic, and a form resembling crinkle mosaic. It is suggested that these crops may be the source of infection for the European certified planting material, which rarely produces more than one full crop, and for the most part becomes entirely worthless by the third generation in the country. It is therefore recommended that when harvesting the winter crops, care should be taken to remove all the tubers from the soil, to prevent the appearance of volunteer plants in the summer crops, or

better still that the latter should not be sown within a certain distance from the former. Studies are in progress to find localities in the State where the European varieties may be grown for local seed-tuber production without danger of outside infection.

Köhler (E.). **Über den gegenwärtigen Stand der Erforschung des Kartoffelabbaus.** [On the present status of research on Potato degeneration.]—*Forschungsdienst*, iv, 2, pp. 81–90, 1937.

This is a survey of recent contributions to the solution of the potato degeneration problem [*R.A.M.*, xvi, p. 828 *et passim*], the various aspects of which have all been referred to from time to time in these pages.

Mader (E. O.). **Potato yellow dwarf and medium Red Clover.**—*Amer. Potato J.*, xiv, 9, pp. 293–295, 1937.

A general survey of New York State for the presence of yellow dwarf of potatoes [*R.A.M.*, xvi, p. 56], begun in 1936 and still incomplete, showed the clover leafhopper [*Agallia sanguinolenta*] to be ubiquitous, but only individuals from certain sections are viruliferous. The disease, moreover, is largely restricted to areas where medium red clover (*Trifolium pratense*) is grown. Should this preliminary evidence be confirmed, it may be possible to combat yellow dwarf by the substitution of other clovers for the medium red, rather than by the more difficult elimination of the insect vector.

Dhein (A.). **Einfluss der Kalisalzdüngung auf die Widerstandsfähigkeit der Kartoffel gegen Schorf.** [The influence of potash salt manuring on the resistance of the Potato to scab.]—*Pflanzenbau*, xiv, 3, pp. 99–111, 1937.

A fully tabulated account is given of the writer's experiments at Bonn University to determine the influence of manuring with potash salts on the incidence of scab [*Actinomyces scabies*] in Industrie potatoes [*R.A.M.*, xiii, p. 51; xvi, p. 404]. In comparison with the repressive effects on the disease of ammonium sulphate and superphosphate the action of potash is relatively weak. In general, potassium sulphate+ magnesium sulphate exerts the most beneficial effect, but on clay soils the use of 40 per cent. potash salt gives better results. Potassium sulphate alone does not afford adequate protection against scab on physiologically alkaline soils, whereas on those with an acid reaction it is approximately equal in efficacy to the potassium and magnesium sulphate combination. No definite correlation could be traced between the degree of severity of scab and soil reaction, and it is doubtful, therefore, whether the influence of fertilizers on the disease is connected with this phenomenon.

Pittman (H. A.). **The Rhizoctonia and common scab diseases of Potatoes.**—*J. Dep. Agric. W. Aust.*, Ser. 2, xiv, 3, pp. 288–301, 7 figs., 1937.

In giving a brief, popular account of the various forms of attack of the potato by *Corticium vagum* [*C. solani*] the author states that in Western Australia the fungus is most injurious to the plants sown in the spring or autumn, both by reducing the stands in the initial stages of growth and by forming stem cankers in plants that are attacked in

more advanced stages of development. The formation of sclerotia on the tubers is apparently stimulated by falling temperatures, and the most heavily scabbed tubers are dug from drained peaty swamps in the autumn. The control measures recommended include crop rotation, avoiding sowing the potatoes in the spring or autumn, especially on infected soil or if the seed tubers have not been disinfected, as early harvesting as feasible, and seed-tuber disinfection with cold or hot formalin, or cold mercuric chloride solutions, the preparation of which is discussed.

An account is also appended of common scab (*Actinomyces scabies*), together with recommendations for its control, much on the same lines as for *C. solani*, except that the use of manures or soil dressings tending to raise the alkalinity of the soil, which favours common scab, is not advised.

Cristinzio (M.). **Esperienze intorno alla capacità infettiva della Rhizoctonia solani Kühn a mezzo di tuberi di Patata infetti.** [Experiments on the infective capacity of *Rhizoctonia solani* Kühn carried out by means of infected Potato tubers.]—*Ric. Ossvz. Divulg. fitopat. Campania ed Mezzogiorno* (*Portici*), vi, pp. 71–94, 2 pl., 2 figs., 1937.

When seed tubers of the Borger, Böhms, Pepo, and Riccia di Napoli potato varieties were planted in two successive years at Portici in lots averaging, respectively, 95, 60, 30, 10, and 0 and 80, 50, 25, 10, and 0 sclerotia of *Rhizoctonia* [*Corticium*] *solani* [*R.A.M.*, xvi, p. 770] it was found that the use of the infected seed tubers favoured early attack on the young shoots of the plants, with a resultant high percentage of deaths. The yield from the infected seed tubers was normal quantitatively, but of subnormal quality. Plants that escaped early infection produced mostly small, commercially valueless tubers in numbers closely correlated with the amount of stolon infection. The plants from the infected seed tubers always gave more diseased than healthy tubers, the intensity of infection of the progeny being directly proportional to that of the seed pieces, while many of the young tubers showed more sclerotia than the parent tubers. In both seasons the uninfected controls gave no plant that succumbed to early infection, the produce was good in quantity and quality, and the number of infected tubers was practically negligible.

It is concluded that the results obtained with the plants from the infected tubers were in fact due to the presence of the fungus on the seed and not to soil-borne infection. The most resistant variety was Riccia di Napoli, followed in order of increasing susceptibility by Böhms, Pepo, and Borger. In general, the early varieties were the least resistant.

Suzuki (H.). **Studies on the relations between the anatomical characters of the Rice plant and its susceptibility to blast disease.**—*J. Coll. Agric. Tokyo*, xxiv, 3, pp. 181–264, 15 pl., 6 figs., 1937.

This is an exhaustive discussion, accompanied by 47 tables, of the author's further studies on the relation between the anatomical features of rice plants and their reaction to blast [*Piricularia oryzae*] on dry and flooded soils in Japan, the varieties used being Kamaji, Kamejiichigô, and Mubôaikoku (all resistant) and Nakateshinriki, Omachi, Miyako,

and Kokuryômiyako (susceptible) [*R.A.M.*, xvi, p. 201]. The results fully confirmed his earlier conclusions and showed that the thickness of the outer walls and the silicated outermost layer of the epidermal cells, and the number of silicated bulliform cells, silicated long or short cells, and silicated stomata are greater in resistant than in susceptible varieties and on flooded than on dry soil (earlier work having shown that susceptibility is in inverse proportion to soil moisture), while the number of stomata does not appear to be correlated with the susceptibility to disease.

Marland (A. G.). К вопросу о взаимоотношениях почвенных грибов. [On the problem of the interaction of soil fungi.]—*Pl. Prot., Leningr., 1937*, 13, pp. 88–91, 1937.

In the experiments briefly described in this paper *Fusarium culmorum*, *Zygorrhynchus moelleri* [*R.A.M.*, xvi, p. 558], and *Z. heterogamus* gave luxuriant growth when cultured separately on malt peptone agar or carrot decoction agar. When *F. culmorum* was transferred to the medium taken from under the *Z. heterogamus* culture it again produced vigorous growth, but developed only sparsely on the substratum from under the *Z. moelleri* culture. Both species of *Zygorrhynchus* failed to develop when transferred to the *F. culmorum* substratum. In a parallel series of tests, wheat grown on soil inoculated with *F. culmorum* alone showed 66 per cent. infection; this percentage was raised to 75 when *Z. heterogamus* was added to the inoculum, and reduced to 60 when the additional organism was *Z. moelleri*. The problems raised by these results are being investigated from a theoretical standpoint.

Naftel (J. A.). **Soil liming investigations: V. The relation of boron deficiency to over-liming injury.**—*J. Amer. Soc. Agron.*, xxix, 9, pp. 761–771, 6 figs., 2 graphs, 1937.

Excessive applications of lime to a Norfolk loamy sand soil in Alabama resulted in over-liming injury, sometimes entailing virtual crop failure, to vetch, turnips, oats, cabbage, tomatoes, and soy-beans. The adverse effects of the treatment were not overcome by the addition of large amounts of phosphorus, soil and plant applications of manganese, or soil amendments of calcium silicate, but the incorporation with over-limed soil of micro-elements including boron (1 p.p.m.) completely prevented the damage, the results being particularly striking in the case of turnips [*R.A.M.*, xvi, p. 722]. In all the crops the over-liming symptoms were typical of boron deficiency.

The mechanism involved in rendering boron unavailable to plants has not been explained. Laboratory experiments indicate that the possibility of insoluble borate precipitation may be discounted, but recent evidence points to an extreme stimulation of bacterial activity by over-liming, reaching the point of acute competition between micro-organisms and higher plants for nutrients present in small amounts.

Cameron Brown (C. A.). **Electrical heating for horticultural purposes.** —*J. Minist. Agric.*, xliv, 6, pp. 552–561, 1937.

After briefly comparing the advantages and disadvantages of electrical and other forms of heating for horticultural purposes the author

discusses, with particular reference to the question of expense, methods of glasshouse and soil heating by electricity. Soil sterilization can be effected electrically in a convenient way by passing the current through copper plates placed at appropriate distances apart in the soil [cf. *R.A.M.*, xv, p. 824 *et passim*]. This method is best suited for use with special boxes containing up to about 10 cwt. of soil. The electrodes may be at either end, the soil being firmly packed between, or one may be on the bottom and the other on the underside of the lid which, when closed, makes contact with the soil. The amount of current and time necessary and the cost of the process depend on the kind of soil, its moisture content, and the efficacy of the packing, but with average potting soil, well packed, the consumption of electricity would amount to about 30 units per cu. yd. This clean, handy method should appeal to amateurs and small growers.

Baldacci (E.). **Ricerche intorno ad una infezione del Ricinus communis attribuita a Fusarium ricini (Berengèr) Bizz.** [Researches on an infection of *Ricinus communis* attributed to *Fusarium ricini* (Berengèr) Bizz.]—*Atti Ist. bot. Univ. Pavia*, Ser. IV, x, pp. 37–49, 1 fig., 1937. [English and Latin summaries.]

In this expanded account of his investigations into a disease of castor (*Ricinus communis*) in Italy [*R.A.M.*, xvi, p. 560] the author states that the condition, which appeared to be identical with one attributed in 1865 in Italy to *Fusisporium ricini*, renamed by Bizzozero *Fusarium ricini* in 1885, developed on a large scale after rainy weather in plants that were still flowering. Dark brown spots formed on the stems, leaves, and inflorescences, the leaves became badly lacerated, and floral development was arrested, but after about three weeks new leaves and flowers were put out. From infected material the author isolated *Verticillium roseum*, *Fusarium scirpi*, *F. moniliforme* [*Gibberella moniliformis*], and *F. semitectum*, an undetermined *Fusarium* and *Macrosporium cavarae* [ibid., ix, p. 489] also being isolated from infected seeds. Infection was probably due to at least two fungi, *M. cavarae* producing the leaf-spotting and attacking the apices of the seeds, and a *Fusarium* species producing lesions on the stems, inflorescences, capsules, and seed apices, this fungus probably being followed by the others.

Inoculations of castor seedlings with *F. scirpi*, *F. semitectum*, *G. moniliformis*, and *F. sambucinum* gave negative results except in a few cases in which the plants had been much weakened by unfavourable environmental conditions. Both *M. cavarae* and the *Fusarium* species involved are regarded as weak parasites. *Fusarium ricini* should be excluded from the valid nomenclature as a *nomen compositum*.

Borzini (G.). **Osservazioni sul parassitismo della 'Sclerotinia libertiana' Fuck. associata ad altri funghi.** [Observations on the parasitism of *Sclerotinia libertiana* Fuck. associated with other fungi.]—*R.C. Accad. Lincei*, xxv, 8, pp. 401–404, 1937.

Towards the end of 1936, fennel (*Foeniculum vulgare*) plants growing near Rome showed a light infection of the outer covering of the bulb by *Sclerotinia sclerotiorum* [*R.A.M.*, ix, p. 202] and, in some cases, a

much more serious infection by the same fungus in association with two undetermined species of *Pythium*.

When wounded bulbs were inoculated with mycelium of *S. sclerotiorum* alone infection progressed much more rapidly than when the inoculations were made with an intimate mixture of mycelia of *S. sclerotiorum* and each species of *Pythium*, or *Phytophthora parasitica*, or *P. citrophthora*, the fungi showing distinct mutual antagonism. In some of the mixed inoculations the two fungi separated in the host parenchyma, in which case the progress of each was less retarded. When the two inocula were placed in the wound without being intimately mixed they developed independently of each other on opposite sides of the incision, the lesions enlarging only slightly less rapidly than lesions due to *S. sclerotiorum* alone. When two cuts 4 to 5 cm. apart were made in each bulb and the mycelium of *S. sclerotiorum* was inserted in one and that of one or other of the remaining fungi in the other, the two lesions at first spread as quickly as those due to the single control inoculations, but as soon as they drew near to one another there was marked increase in the pathogenic activity of *S. sclerotiorum*, which rapidly invaded the whole plant, surrounding the other fungus and completely arresting its growth. The host tissues rapidly became disorganized and were reduced to a mass of sclerotia, though other fennel plants inoculated on the same date with *S. sclerotiorum* alone showed only localized infection in the bulb. One *Pythium* species and the two *Phytophthora* species when inoculated separately into fennel were only very weakly pathogenic.

These results were confirmed when the fungi were grown on fennel agar. When *S. sclerotiorum* and one of the other fungi were sown 4 cm. apart in the same dish *S. sclerotiorum* made better growth with the two species of *Phytophthora* than with the two *Pythium* species and better growth with the latter than when cultured alone.

It is concluded that the *Pythium* infections observed in nature contributed to the appearance or spread of the sclerotial disease, which has not been recorded before on fennel in Italy. *S. sclerotiorum* becomes more virulent by absorption of the metabolic products of fungi associated with it.

Shepherd (E. F. S.). **The gumming disease of the Sugarcane.**—*Bull. Dep. Agric. Mauritius* 25, 9 pp., 1937.

In this account of the symptoms, etiology, and control of gumming disease of sugar-cane (*Bacterium vasculorum*) [*R.A.M.*, xvii, p. 67] the author states that the condition has been a factor in the disappearance of many important cane varieties from cultivation in Mauritius. Little damage is now caused over the island taken as a whole, owing to the fact that more resistant varieties are grown, but the loss of yield resulting from the fact that some of these, including White Tanna, are of poorer quality than the susceptible varieties they replaced, is indirectly a loss due to the disease.

D. S. North has proved in Fiji, New South Wales, and Queensland that the disease can be eradicated in an infected area by the continuous and exclusive use of resistant varieties. In Mauritius, new seedlings are tested for resistance to gumming after their second year's general performance trial, two holes of each being tested. A flank row of 55/1182

is planted along each side of the plot at right angles to the two-hole lines of seedlings. In addition, a standard variety of known reaction to gumming is also planted each year in the plot. The shoots in the flank rows are inoculated when about five months old by stabbing the spindles with an instrument dipped into a suspension of gum exudate in water. In about a fortnight gumming stripes develop on the leaves, which 'bombard' the seedlings with infection. The gum used is selected from several different localities. Seedlings not highly resistant are subjected to a further test. The stems of all seedlings found to be commercially resistant are immediately examined, as a resistant variety may develop systemic infection in a number of shoots. The plots are inspected at least once every two months.

Chupp (C.). **Cercospora species and their host genera.**—Issued by Dep. Plant Path., N.Y. (Cornell), 23 pp., 1937. [Mimeographed.]

This is a list of 1,384 species of *Cercospora* [*R.A.M.*, xvi, pp. 128, 398, 562, 633] arranged alphabetically according to the specific name with numbers indicating the host genera, which are listed separately on pp. 15–23 with cross-references by numbers to the species found on them.

Mitter (J. H.) & Tandon (R. N.). **Fungi of Allahabad, India.—Part III.**—*Proc. Indian Acad. Sci.*, Sect. B, vi, 3, pp. 194–201, 1937.

A list is given of 117 fungi collected at Allahabad since the publication of part II of 'The fungous flora of Allahabad' [*R.A.M.*, x, p. 210].

Baldacci (E.). **Un nuovo genere di micete parassita del Pioppo, Pollaccia radiosa (Lib.) Baldacci e Ciferri. Revisione dei G. Stigmella e Stigmina.** [A new genus of fungus parasitic on Poplar, *Pollaccia radiosa* (Lib.) Baldacci & Ciferri. A revision of the genera *Stigmella* and *Stigmina*.]—*Atti Ist. bot. Univ. Pavia*, Ser. IV, x, pp. 55–72, 5 figs., 1937. [Latin and English summaries.]

Examination of herbarium material of the fungus originally described as *Oidium radiosum* [*R.A.M.*, xvi, p. 423] showed that the conidiophores were either lacking or reduced to a papilla, while the conidia measured 23 to 25 by 7 to 10 (when more developed up to 42 by 12) μ, were sessile or borne on a hyaline papilla, uniseptate when young, and when mature typically biseptate with a central cell measuring 15 by 9 μ and two end cells 7·5 by 5 to 6 μ, of which the apical one was subrotund and the basal one conical or acute, both being a lighter colour than the central one. The fungus differs fundamentally in the characteristic shape, unequal septation, and colour of its conidia from *Stigmella* and *Stigmina*, and from *Fusicladium* and *Napicladium* in that these have fusiform or piriform conidia. It is therefore transferred to a new genus *Pollaccia* Bald. & Cif. [a Latin diagnosis of which is given], characterized by biseptate conidia with unequal, elongated, thickened cells, of which the centre one is dark and the two end ones light, as *P. radiosa* (Lib.) Bald. & Cif. Synonyms of the fungus include *Cladosporium ramulosum*, *C. asteroma* and its var. *microsporum*, *Fusicladium tremulae*, and *Stigmina radiosa* [loc. cit.].

From his study of authentic material of *Stigmella dryophila*, *S. montellica*, *Stigmina platani*, and *S. briosiana* the author concludes that

all these species belong to the genus *Stigmella* Lév. emend. Baldacci [a revised Latin diagnosis of which is given] characterized by globose, ovoid, or cylindrical, very dark conidia transversely bi- or pluriseptate, with or without longitudinal septa. The genus is subdivided into four subgenera, *Eustigmella*, *Stigmina*, *Montellia*, and *Farnetina*, represented, respectively, by *Stigmella dryophila*, *S. platani*, *S. montellica*, and *S. briosiana* (Farneti) Baldacci (= *Stigmina briosiana* Farneti).

Subba Rao (M. K.). **Report of the Mycologist, 1936–37.**—*Adm. Rep. Tea sci. Dep. unit. Plant. Ass. S. India, 1936–37*, pp. 25–33, 1937.

During the period under review the leaf spot of tea caused by *Cercosporella theae* [*R.A.M.*, xvi, pp. 1, 636, 798] was recorded from the Nilgiris and Anamallais. The disease appears to be favoured by misty weather rather than actual precipitation.

Although the black rot due to *Corticium invisum* [ibid., xv, p. 748] is reported only from one estate in Travancore, the disease is believed to be widespread elsewhere, especially in districts exposed to a heavy rainfall.

No tendency to spread has been shown by witches' broom, a cytological study of leaves affected by which has been commenced. The chloroplasts in the diseased foliage are small and few, while the palisade cells are occupied by numerous yellowish-brown, often pale green-tinted, globular bodies of varying dimensions, which are present only to a very limited extent in corresponding healthy material.

Of the various common antiseptic paints tested for the treatment of pruning cuts, the most effective and simplest to apply were carbolineum [ibid., xvi, p. 783], cargillineum [cf. ibid., xv, p. 734], and Mason's mixture, the last-named being particularly recommended for estate practice as requiring no heating prior to use and retaining its colour well for checking purposes.

Parodiella grammodes caused almost complete defoliation of *Crotalaria anagyroides* [ibid., xi, p. 748], which was also attacked by a species of *Fusarium* inducing wilt.

Tryblidiella rufula [cf. ibid., xv, p. 344] was found on *Grevillea* branches and on citrus shoots previously infected by *Corticium salmonicolor*.

Lehman (S. G.). **Ruffle-leaf: a new disease of Tobacco in North Carolina.**—*Plant Dis. Reptr*, xxi, 16, pp. 296–297, 1937. [Mimeographed.]

From 7 to 10 per cent. of the tobacco plants in fields covering an area of about 20 acres near Raleigh, North Carolina, were observed in August, 1937, to be suffering from a disease strongly reminiscent of 'kroepoek' [leaf curl], as described from South Africa and the Dutch East Indies [*R.A.M.*, xvi, p. 414] but which the writer prefers to term 'ruffle leaf' pending further studies on its exact identity.

Chamberlain (E. E.). **Tobacco mosaic. Its appearance, cause, and control.**—*N.Z. J. Agric.*, lv, 3, pp. 163–174, 1937.

Tobacco mosaic is stated to have become a major problem in the Nelson district of New Zealand [*R.A.M.*, xvi, p. 418] only in the last five years, the estimated average infection having increased from under 10 per cent. in 1933 to well over 25 per cent. in 1937. The disease is also

present, though much less widely, in Auckland Province. Leaf-spotting is a very destructive feature in New Zealand, and in one crop of Burley tobacco, examined in 1933, was so severe that 20 per cent. of the crop remained unpicked. Experiments at Palmerston North showed that infection when occurring shortly after the plants had been set out in the field caused 44 and 78 per cent. reduction of yield in a Virginian and a Burley variety, respectively; leaf from the affected plants was useless. Infection later in the season caused corresponding losses of 24 and 25 per cent. Other hosts attacked locally are tomato, black nightshade [*Solanum nigrum*], Cape gooseberry [*Physalis peruviana*], Turkestan tobacco, eggplant, and chilli [*Capsicum annuum*], of which only the first two are likely to play any part in transmission to tobacco.

Healthy plants, from which the laterals were removed by two men who had previously performed the same operation on mosaic plants, developed 83 per cent. infection after three weeks. Experimental evidence showed that where the disease has been present in a seedling-bed it may remain in the soil and infect the seedlings in the following season; in one instance in which seedlings were planted in such a bed, the plants developed over 11 per cent. infection after being transplanted to the field. In another case, when 129 healthy tobacco plants replaced infected ones in the field 72 per cent. of the former became diseased. Preliminary trials indicated that the disease may be carried to a small extent in or with the seed. It is also borne in a small percentage of seed from infected tomatoes and *S. nigrum*.

The paper terminates with recommendations for control.

Shapovalov (M.) & Lesley (J. M.). **A Tomato resistant to two wilts.** —Abs. in *Phytopathology*, xxvii, 9, p. 955, 1937.

Brief particulars are given of the Riverside tomato variety, recently developed by the United States Department of Agriculture in co-operation with the University of California for resistance to the two wilt diseases infesting certain soils of the coastal belt, viz., *Verticillium albo-atrum* [*R.A.M.*, xv, p. 519] and *Fusarium* [*bulbigenum* var.] *lycopersici* [ibid., xvi, pp. 157, 419]. The new hybrid, originating from a cross between Cal 2, somewhat resistant to *V. albo-atrum*, and Marvana, resistant to *F. bulbigenum* var. *lycopersici*, gave much more satisfactory results in repeated trials on wilt-infested soils than several leading commercial varieties tested simultaneously. Riverside is a late maturing type and so primarily adapted for late shipping purposes. Cultural studies in connexion with these experiments indicated that the prevalence of *Fusarium* wilt tends to increase during the hotter part of the growing season, whereas *V. albo-atrum* is liable to predominate, often to the exclusion of the *Fusarium*, with the onset of cooler conditions.

Tisdale (W. B.) & Hawkins (S. O.). **Experiments for the control of Phoma rot of Tomatoes.**—*Bull. Fla agric. Exp. Sta.* 308, 28 pp., 1937.

A full account is given of experiments carried out in Florida from 1931 to 1935, inclusive, on the control of *Phoma* rot (*P. destructiva*) of tomatoes [a preliminary note on which has already appeared: *R.A.M.*, xiv, p. 475; xvi, p. 419]. Since the disease was first recorded on tomatoes dispatched from the lower east coast of Florida in 1915, it has become

the chief cause of spoilage in tomatoes sent from Florida, and the second chief cause of spoilage in winter-grown tomatoes in transit from certain other southern States. It is known to develop most rapidly in ripe fruits at about 70° F., and does not spread from diseased to adjacent healthy fruits in packing cases. Stem scars, growth cracks, or mechanical injuries must be present before the fungus can effect an entry but it was observed to occur extensively on the foliage of the winter crop at Homestead, Florida, during seasons of moderate temperature and high humidity. In warm, dry seasons prevalence is much reduced and the damage caused is little or none. Applications (as a rule 8 in number) of Bordeaux mixture (4–4–50), usually with calcium caseinate added, increased the yields of marketable fruit, and prevented the development of a high percentage of infection in stored fruits during seasons favouring the disease, but in warm, dry seasons reduced the yields of marketable fruit. Infection was further reduced by washing the tomatoes immediately after picking with 5 per cent. borax, 1 per cent. sodium hypochlorite, or 1 in 150 sodium polysulphide solution, each with 0·5 per cent. liquid soap as a wetting agent. The borax solution was slightly better than the others. The solution was placed in tubs or barrels at the ends of the rows, and the fruits were dipped before being placed in field boxes for hauling to the packing sheds. Picking the fruit while wet increased infection in storage. Of the varieties tested Livingstone's Globe, Marglobe, and Pritchard were the most resistant to both leaf and fruit infection; in 1935–6 the Rutgers variety was the most resistant to leaf infection.

Fajardo (T. G.). **The Tomato leafmold (Cladosporium fulvum Cke.), a new serious disease of Tomato in Baguio, Mountain Province.**— *Philipp. J. Agric.*, viii, 2, pp. 163–186, 12 pl., 1937.

Field and glasshouse studies carried out in Baguio, Mountain Province, Philippine Islands, on tomato leaf mould (*Cladosporium fulvum*) [*R.A.M.*, xvi, p. 660] showed that at present the disease is confined to the local experiment station where it occurs in the glasshouse and in the field and may cause very serious losses, the climate being ideally favourable to infection. Under the conditions prevailing in the vicinity, the spores germinate readily in the presence of moisture in the glasshouse, laboratory, or open, with and without shade. Tomatoes readily become infected as a result of spraying both sides of the leaves with an aqueous suspension of spores, the symptoms developing in 10 to 15 days. The evidence indicated that the fungus remains viable for 4 to 8 months in the glasshouse. No tomato variety tested was entirely resistant, but the author's selections from Burpee's Self Pruning are recommended for glasshouse culture for the time being in place of the other varieties so far tested.

Rombouts (J.). **Algumas palavras sobre uma molestia cryptogamica, prejudicial aos Tomateiros, na Bahia, causada por 'Septoria lycopersici' Speg.** [A few words concerning a cryptogamic disease of Tomatoes in Bahia, caused by *Septoria lycopersici*, Speg.]— *Rodriguésia*, ii, 8, pp. 45–49, 2 figs., 1937.

The author states that in December, 1936, tomatoes grown at the

General Experimental Station of Agua-Preta, Bahia, Brazil, were practically completely destroyed by attacks of *Septoria lycopersici* [*R.A.M.*, xvi, p. 113, 279, 655], a fungus which is also prevalent in other districts of Brazil. The outbreak at the Station was particularly severe on tomatoes affected with virus diseases, and observations indicated that the fungus developed most vigorously on the chlorotic spots and curled areas of the leaves.

BEST (R. J.). **On the presence of an 'oxidase' in the juice expressed from Tomato plants infected with the virus of Tomato spotted wilt.** —*Aust. J. exp. Biol. med. Sci.*, xv, 3, pp. 191–199, 1937.

The juice expressed from the leaves of Dwarf Champion, Early Dwarf Red, Sensation, and Early Dwarf Red × Break o' Day tomatoes infected by the spotted wilt virus [see above, p. 126] was found to contain an 'oxidase' enzyme, tentatively identified as tyrosinase, which catalyses the oxidation of phenol, catechol, quinol, and tyrosin in the presence of air. The reaction does not proceed to a demonstrable extent in suspensions of juice expressed from the same organs of healthy plants but does so in suspensions of healthy root juice. The enzyme was also present in the juice of Blue Pryor tobacco leaves infected by spotted wilt but not in that of Golden Gleam nasturtium [*Tropaeolum majus*] similarly attacked. The juice of infected field-grown tomato plants was further found to contain an autoxidizable substance, the oxidized form of which was capable of inactivating the virus *in vitro* in suspensions buffered at P_H 7. It was concluded that the rapid oxidation of this autoxidizable substance in air is catalysed by the enzyme and that the oxidized form of the substance inactivates the virus by direct oxidation. A similar explanation is offered in respect of the rapid inactivation of the tomato spotted wilt virus in suspensions containing phenol, catechol, or quinol exposed to air. In the presence of free oxygen the enzyme catalyses the oxidation of the phenols and the oxidation products then inactivate the virus.

The bearing of these data on some plant-virus interrelationships, and on the handling of virus suspensions, is discussed in the light of recent studies by the author [ibid., xvi, p. 778] and others.

FRANSEN (J. J.). **Verslag over de onderzoekingen betreffende Iepenziekte en Iepenspintkevers.** [Report on the investigations relating to Elm disease and Elm bark beetles.]—*Tijdschr. PlZiekt.*, xliii, 9, pp. 195–217, 1937.

The following are among the items of interest in this comprehensive report of recent investigations in Holland on various aspects of the elm disease (*Ceratostomella ulmi*) and the relationship of elm bark beetles (*Scolytus scolytus* and *S. multistriatus*) to its development [*R.A.M.*, xv, p. 126; xvi, p. 844, and next abstracts]. Conflicting results were given by experiments in the inoculation of resistant and susceptible varieties with and without the intervention of the beetles, presumably owing to unfavourable weather conditions for the insects. In one series three resistant varieties, *Ulmus wallichiana* and seedlings 24 and 44, contracted the disease as a sequel to the conveyance of inoculum by the beetles but did not react to direct injections with a spore suspension

of the fungus, while in another even the most susceptible varieties did not become diseased from inoculation by means of the beetles but responded positively to injections.

The following varieties, exposed to natural infection in the field by means of bark beetles, remained healthy in 1933 and 1934: *U. pumila*, *U. foliacea dampieri*, *U. sieboldii*, *U. macrocarpa*, and seedlings 1 and 24; *U. macrocarpa* further maintained its resistance to *C. ulmi* in 1935, when *U. wilsoniana*, which in 1934 exuded extensive quantities of sap, was also not infected. The W1 variety was shown by inoculation experiments in 1935 to be almost as susceptible as the Dutch elm. Some uninoculated trees showing die-back of the crowns in 1934 were found to be infected by *Nectria*, *Phomopsis*, and *Alternaria* spp. and *Papularia sphaerosperma*.

Cases have been observed in which both old and young trees have suddenly succumbed to a recrudescence of infection by *C. ulmi* after a period of abeyance; even such relatively resistant varieties as *U. foliacea dampieri*, *U. foliacea aurea*, and *U. glabra fastigiata* may be affected in this way. Trees have also been found to harbour the fungus for lengthy periods (nine years in one instance) without showing any symptoms of infection.

Discussing the spread of the elm disease in Europe, the writer points out that infection has travelled much more rapidly in an easterly than in a northerly direction. Various theories may be advanced in explanation of this phenomenon, of which the most plausible appears to be based on the scarcity or absence of bark beetles in the northern countries, except Sweden, where several species of *Scolytus* are represented. The disease may gradually extend to the northernmost limit of distribution of the insects.

FRANSEN (J. J.). **De verbreiding van Ceratostomella ulmi (Schwarz) Buisman door den wind.** [The dissemination of *Ceratostomella ulmi* (Schwarz) Buisman by the wind.]—*Tijdschr. PlZiekt.*, xliii, 9, pp. 218–222, 1937.

Full details are given of the writer's experiments, carried out by various methods, including a technique specially devised for the purpose and described at length in *Vakbl. Biol.*, xvii, 1, pp. 7–10, 1935, to determine the part, if any, played by the wind in the dissemination of *Ceratostomella ulmi* [*R.A.M.*, xiv, p. 611 and preceding and next abstracts]. The results of the tests showed that not only the various types of spores of *C. ulmi*, but also its mycelium, are ill adapted to transmission by air currents, the role of which in the spread of the fungus must consequently be regarded as negligible. It is true that the infected dust ejected by the elm bark beetles [*Scolytus scolytus* and *S. multistriatus*] in the course of boring through the cortex may be conveyed by the wind to healthy trees, but in such cases it is the insects that are primarily instrumental in the distribution of the fungus. The beetles not only prepare the pupal chambers in which the coremia of *C. ulmi* are formed but they inflict the wounds through which the fungus gains ingress into healthy trees. In Holland, at any rate, these insects may be regarded as the sole effective means of transmission of the elm disease.

FELT (E. P.). **Balloons as indicators of insect drift and of Dutch Elm disease spread.**—*Bull. Bartlett Tree Res. Lab.* 2, pp. 3–10, 1 map, 1937.

Between 9th May and 23rd July, 1936, 4,935 toy balloons were released with requests to the finders for their return to the Bartlett Tree Research Laboratory, Stamford, Connecticut, with a view to determining the possible implication of wind in the distribution of the Dutch elm disease [*Ceratostomella ulmi*: see preceding and next abstracts]. From the 208 returns it seems evident that the distant spread of the disease from the original focus of infection to the north-east is associated with the conveyance of the bark beetles [*Scolytus scolytus* and *S. multistriatus*], the carriers of the fungus, by the wind.

GOSS (MARIE C.) & MOSES (C. S.). **A bibliography of the Dutch Elm disease.**—61 pp., U.S.D.A., Bur. Pl. Ind., Div. For. Path., 1937. [Mimeographed.]

This bibliography, a revised (to May, 1937) and expanded edition of a similar list published in 1935, comprises 678 titles of papers appearing on the Dutch elm disease (*Graphium* [*Ceratostomella*] *ulmi*) [see above, pp. 81, 125 and preceding abstracts] in scientific, semi-scientific, and certain popular American and foreign journals.

MIELKE (J. L.), CHILDS (T. W.), & LACHMUND (H. G.). **Susceptibility to Cronartium ribicola of the four principal Ribes species found within the commercial range of Pinus monticola.**—*J. agric. Res.*, lv, 5, pp. 317–346, 1 map, 5 graphs, 1937.

A full report is given of studies from 1924 to 1928 in British Columbia and in 1933 and 1934 in the white pine region of northern Idaho to determine the relative importance of *Ribes petiolare*, *R. inerme*, *R. viscosissimum*, and *R. lacustre* [*R.A.M.*, xiv, p. 66; cf. also xvi, p. 74] in the spread of white pine blister rust (*Cronartium ribicola*) in North America, as judged by their susceptibility to infection with the rust and the abundance of teleutosori produced on them. The results of the tests (involving a total of nearly 3,900,000 *Ribes* leaves) were recorded on the lines of a system devised for the needs of the work, and which is fully described. *Ribes* species other than the four named are stated to be seldom met with in the commercial range of the western white pine (*Pinus monticola*) in the United States. *R. petiolare* was found to be highly susceptible, approaching cultivated black currant both in severity of infection and production of teleutosori, while *R. inerme* equalled or even surpassed it from both standpoints when growing in the shade. The other two species are more resistant; *R. lacustre* may occasionally become moderately infected but its production of teleutosori is almost always quite low. The investigations included the open, shade, and part-shade forms of the four species; relative susceptibility of these forms and the ratios of teleutospore production to percentages of leaf surface infected remained fairly constant; weather and other environmental conditions caused, however, marked local and annual differences in the degree of infection between individuals and groups of individuals of the same species and form; there also was evidence of inherent differences in susceptibility between individuals.

Amtliche Pflanzenschutzbestimmungen. [Official plant protection regulations.]—*NachrBl. dtsch. PflSchDienst*, ix, 6, p. 135, 1937.

YUGOSLAVIA. A Decree of the Minister of Agriculture, dated 13th January, 1937, prohibits the importation of Douglas fir (*Pseudotsuga douglasii*) [*P. taxifolia*] seedlings with a view to the exclusion from Yugoslavian territory of *Rhabdocline pseudotsugae* [see above, p. 85].

Legislative and administrative measures.—*Int. Bull. Pl. Prot.*, xi, 9, pp. 202–203, 207, 1937.

AUSTRIA (Confederation). Decree No. 103 of 10th April, 1937, enumerates the following countries as being deemed to be free from potato wart disease (*Synchytrium endobioticum*) and whence fresh tubers may accordingly be imported by rail into the Austrian Confederation: Egypt, French Colonies and Protectorates in North Africa, Italy, Yugoslavia, Malta, Rumania, and Hungary [*R.A.M.*, xv, p. 464].

FRANCE. All dealers in insecticides, fungicides, or plant protectives of any description (except copper products) are obliged, by a Decree of 11th May, 1937, to furnish full particulars of the origin of their products, the contents of which in active elements should be indicated by weight per 100 kg. or l. of the preparation [*R.A.M.*, xiv, p. 814]. The active principles are further to be designated by the names of the basic metals or metalloids in the case of simple or compound preparations, by those of the alkaloid components in organic products, or by the patented name under which the substance is marketed. It is also incumbent upon dealers in this class of goods to supply the Ministry of Agriculture with two copies before publication of all catalogues and prospectuses relative to the sale of such products.

A summary of legislation relating to the introduction of plants into the Colonial Dependencies of the British Empire as at the end of December 1936.—65 pp., London, H.M. Stationery Office, 1937. Price 1s.

The data obtained from the various Colonial Dependencies of the British Empire relative to their plant quarantine regulations, in response to action taken by the Secretary of State at the instance of the Third Imperial Mycological Conference held in London in 1934, is here summarized in a uniform manner and grouped geographically. The information here presented in digest form shows the position as at the end of December, 1936. [The Antigua plant and animal importation restrictions are also summarized on pp. 10–13 of the Report on the Agricultural Department for 1936.]

Service and regulatory announcements April–June 1937.—*S.R.A., B.E.P.Q.* 131, pp. 103–202; U.S. Dep. Agric., 1937.

Summaries are given of the plant quarantine import and transit restrictions in force in Egypt, Austria, Malta, Great Britain, Rumania, Argentina, Montserrat, St. Vincent, Gilbert and Ellice Islands, Barbados, St. Lucia, Northern Rhodesia, Belgium, Greece, Sweden, Seychelles, Fernando Po and Spanish Guinea, British Guiana, French Colony of Algeria, French Zone of Morocco, Central America, Southern Rhodesia, Yugoslavia, Belgian Congo, and Iran (Persia).